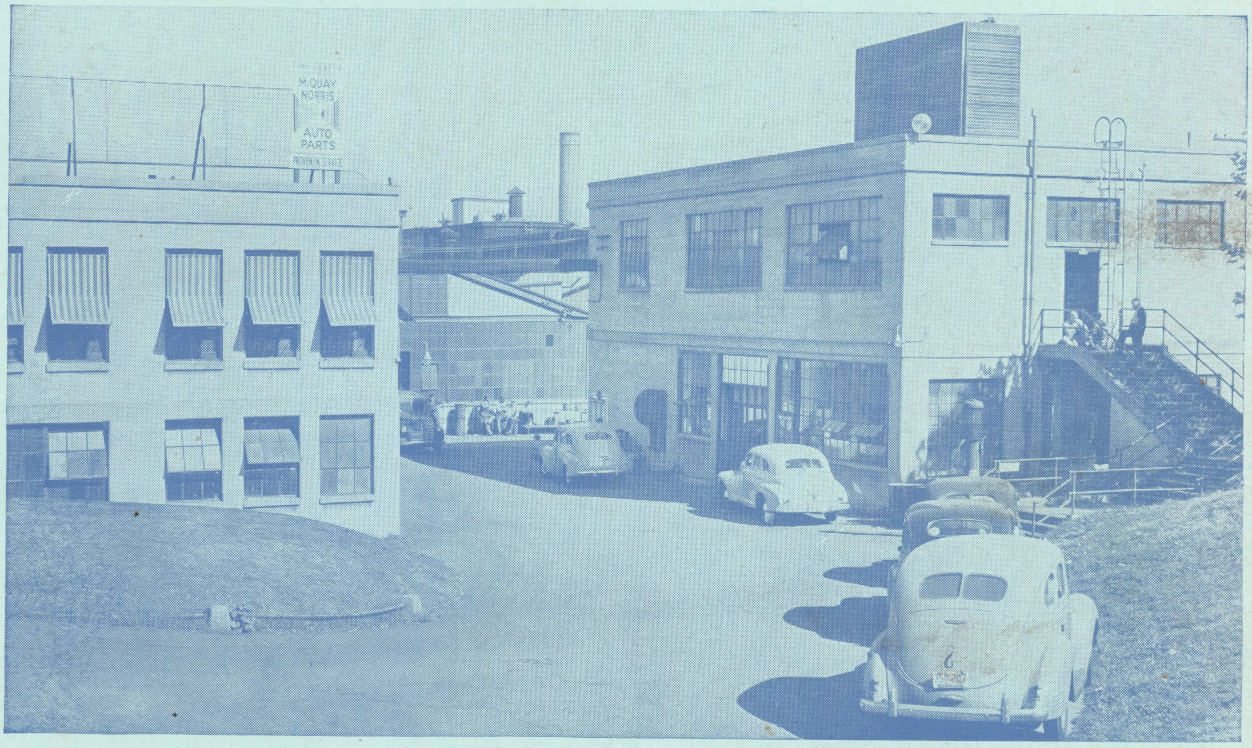
McQUAY-NORRIS SHOP SERVICE

INTRODUCTION TO BULLETIN SERVICE

Bulletin No. 1

On these pages will appear Shop Service Bulletins prepared by the McQuay-Norris Service Engineering Department. Mechanical subjects of timely and seasonal nature will be treated in such a manner as to be of the most benefit in improving engine performance.

The findings and experience of our traveling service engineers as well as our experimental engineers will be edited and illustrated.



Test Cars in Front of Dynamometer Laboratory

McQuay-Norris maintains a modern, well-equipped dynamometer laboratory, with capacity for the testing of 12 engines. And, in order to meet and check every conceivable problem, dynamometer testing is augmented by road testing. A fleet of test cars is maintained constantly under test for determining the performance of engines and to further study ways and means of correcting the various problems that arise in operation. These test cars are driven over a course where most all driving conditions are experienced.

In these bulletins we will first analyze various troubles that are occurring in the field and then explain the operating conditions that can cause such trouble. In each case the most accepted shop practice will be recommended. By knowing the trouble and the causes and the correct procedure, the repairman can take the necessary precautions in doing his work so that trouble can be avoided.

Recommendations made in these bulletins have been carefully worked out from field data and double checking in dynamometer and road tests. We will strive to furnish the most practical and dependable information available.

ENGINEERING DEPARTMENT

ST. LOUIS 10, MO., U. S. A.

Printed in U. S. A.

McQUAY-NORRIS SHOP SERVICE

LOOSE LOCK RING TROUBLE

Bulletin No. 2

It is quite perplexing for a repairman to tear down a motor and discover two vertical grooves the width of the piston pin and the length of the pin travel worn in one or more cylinder walls. Due to the infrequency of this trouble, the causes are not generally understood.

Because the piston bosses usually appear to have melted away just outside the lock rings, and because one or more of the lock rings are found broken or have actually disappeared, a hasty analysis would allege defective lock rings to be the cause. It is true that the lock ring did the damage by getting out of the groove in the piston boss and vibrating in the piston relief between the boss and cylinder wall. Nevertheless it is very unlikely that the lock ring broke due to defective material, or that it came out of its own accord.

Probably the most common cause of a lock ring getting out of the piston groove is misalignment of the connecting rod. A bent or twisted rod will cause the piston to operate in a cocked position which tends to force the pin against one lock ring. This force may be great enough to push the lock ring out of the groove and against the cylinder.

Excessive end play on the crankshaft will cause the pin to continually tap the lock ring until it is either pushed out of the groove or is worn thin and breaks. Pieces of the broken lock ring will shuttle back and forth inside the pin, wearing both sides.

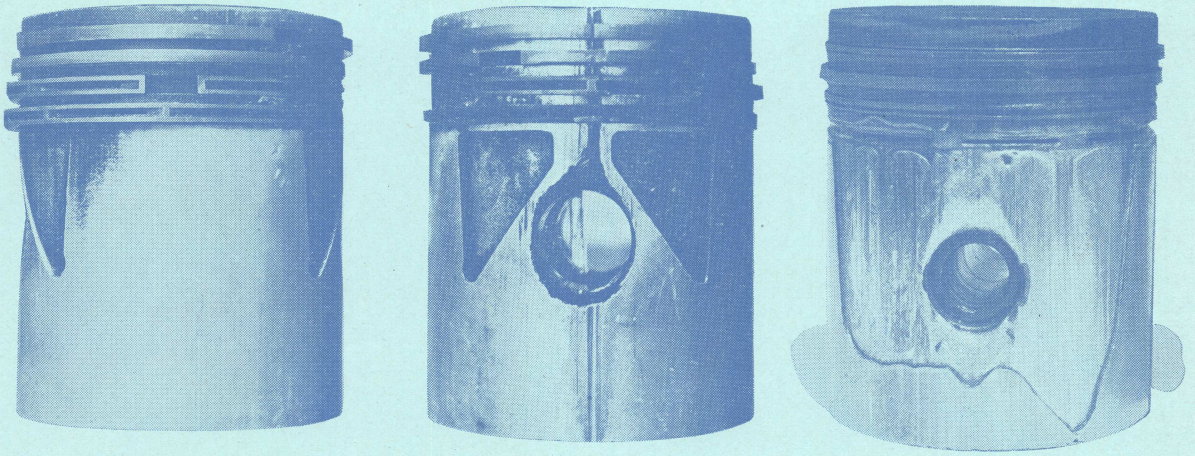
Eventually part of the lock ring will wedge its way between the piston skirt or piston rings and the cylinder wall, with the resulting damage that can easily be imagined.

In some cases this trouble results from a tight fit of the pin in the rod bushing so that any movement of the rod on the shaft or any end play of the shaft itself will cause the pin to hammer the lock ring, knocking it out of the groove.

A corrosive condition, caused by condensation of moisture and the other products of combustion, in the region of the piston pin, will not only corrode the pin and piston, but will also attack the lock rings.

The remaining causes of this trouble have to do with installation of the lock ring itself.

Although the design of many lock rings suggests the use of pliers for installation, it is definitely wrong to install lock rings by compressing the tips completely together with a pair of pliers. Any lock ring will take a permanent set when the tips are forced together more than necessary. For this reason, the design of some lock rings has been recently changed to eliminate one of the ears or bent ends so that they cannot be compressed with pliers.



Evidence of Bent Rod — Wear caused by broken lock ring. Notice top land contact. — Result of pin tight in rod and misalignment.

The proper method of installation is to use a screw driver. One end of a lock ring having two ears, or the straight end of a lock ring having only one ear, should be inserted in the lock ring groove. Then a small screw driver can be hooked over the remaining ear and the tip of the screw driver entered into the hole of the piston pin.

With this set-up, it is comparatively simple to pry the lock ring into the groove without compressing it enough to cause very much permanent set. What little set does take place will in no way effect the operation of the lock ring.

A caution, however, must be made so that lock rings will not be used over and over. It is absolutely essential to install new lock rings on every job in order that the rather serious damage from loose and broken lock rings will not be experienced.

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McQUAY-NORRIS SHOP SERVICE

COOLING SYSTEM WATER DISTRIBUTING TUBE TROUBLE

Bulletin No. 3

This bulletin is prompted by our service engineers recently experiencing many stubborn valve burning and piston scoring jobs that are finally traced to a corroded or clogged water distribution tube.

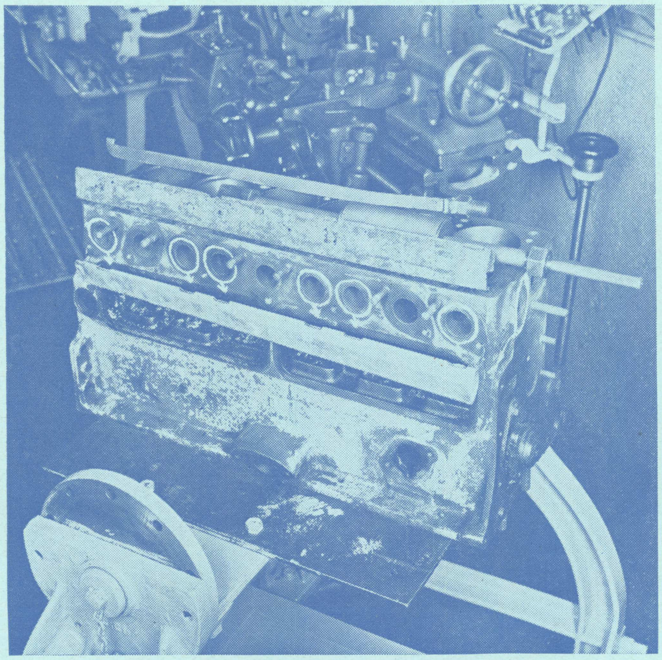

Figure 1.

Of the "L" type engines, Chrysler, DeSoto, Dodge, Ford Six, Oldsmobile, Packard, Plymouth, Pontiac and Studebaker, incorporate in their design some form of the long narrow metal "distributing tube". In original assembly of the engine, it is slid into the block between the row of cylinders and the row of valve ports before bolting on the water pump. This tube has a correctly sized hole or slot at the location of each exhaust valve port. (See Figure 1).

The end of the tube toward the front of the engine is open and usually flared. The cooled water or coolant from the radiator is drawn into the water pump and forced out through the distributing tube which directs it first against the exhaust valve ports. In this way the coolant at its lowest and most effective temperature is made to contact the hottest area in the engine before it circulates around the intake valve ports, the cylinder barrels and back into the radiator. Consequently as far as the subject of this bulletin is concerned, a normal operating temperature is maintained so long as the distributing tube is in a condition to function as just described.

But too many cars now have been running so long that electrolytic corrosion accelerated by aeration has had ample time to eat through the distributing tube making holes where they do not belong or even dissolving the tube completely. Quite often the closed end of the tube is eaten away first, allowing the coolant to rush straight through instead of being distributed properly. As a result, one of the most important features of the cooling system is knocked out.

Thus without effective cooling of the exhaust valve ports, hot spots develop at the valve seats. Then instead of operating at a dull cherry red heat as is normal in modern engines, the exhaust valves overheat and soon burn or warp badly ruining the engine's power and efficiency. Doing a valve job doesn't overcome the cause so the engine becomes known as a chronic valve troublecase.

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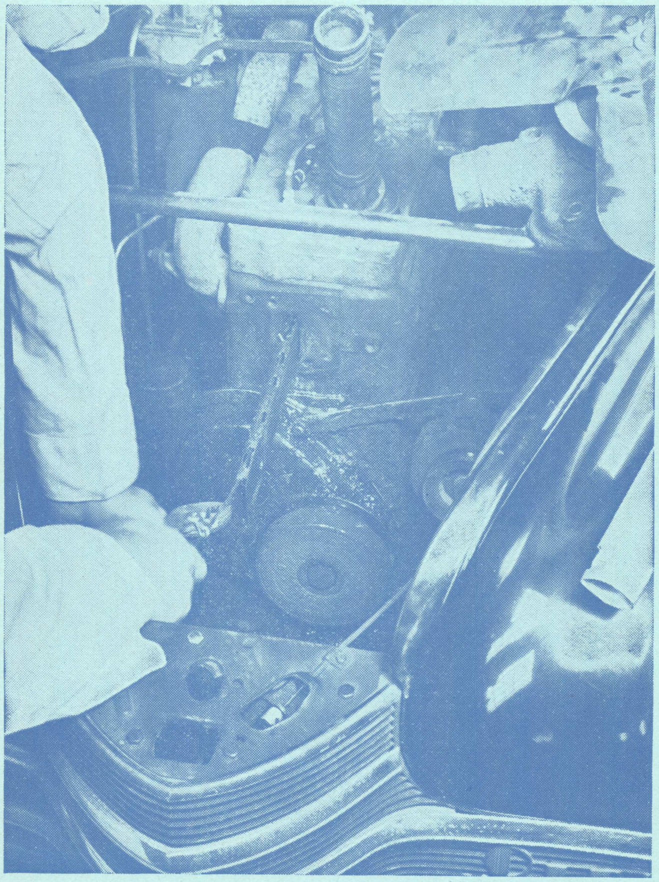

Figure 2.

On the other hand this same overheating can cause distortion of the cylinders playing havoc with piston ring performance and often resulting in piston scoring.

In some cases, it is not so difficult to inspect the condition of the distributing tube. Removal of the water pump is necessary and then with the aid of a mirror and flashlight the inside of the tube can be viewed. In other cases, the tube is corroded so far inside the block that its actual condition can only be determined after removal.

A tube which can no longer function due to excessive corrosion must be replaced. Removal is a difficult task due to the tube's length and usually its frail condition. Since it must be drawn straight out from the front of the block, the radiator core and sometimes the grill must be removed. Then using pliers or a piece of welding rod with a hook bent on the end, the tube can be carefully pulled out all in one piece. (See Figure 2).

Obviously, whenever an engine having considerable mileage is removed from the chassis for any reason, then is a good time to clean or replace the water distributing tube.

While the water pump is off and before installing the new distributing tube, is an opportune time to reverse flush the block to remove all rust and mud settlement that may be affecting the heat transfer.

Notice of a heavy lime and scale deposit calls for a treatment of the block with a six part water to one part muriatic acid solution containing one-half ounce of a good commercial inhibitor per quart of acid solution. After the acid is washed out, neutralize the acid effect by filling the block and head with a caustic (Sal Soda) solution.

The cooling systems of engines mentioned at the beginning of this article depend so completely on the water distributing tube to prevent hot spots and a corroded tube can cause such serious and chronic valve, ring, and piston trouble, that all mechanics working on the old cars now in operation should be conscious of this condition and replace the distributing tubes whenever possible.

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CYLINDER REFINISHING

Service Bulletin No. 4

There are many methods used to refinish cylinders, but the problem is to find the most practical method for the average mechanic to use.

Whether the engine is being reringed or rebored, the important considerations are the finish, trueness and cleanness of the cylinder walls against which the ring faces must seat and seal.

By starting with the accepted purpose or function of piston rings—namely, to seal the piston in the cylinder barrel against the passage of oil and blowby, we can reason out the most practical method under existing circumstances.

Cylinder alignment with crankshaft.

A crankshaft converts the reciprocating power strokes of the pistons into a relatively steady rotating force that turns the transmission, differential and wheels. This mechanism requires accurate alignment between the crankshaft journals and the piston travel. Consequently, since the cylinder bores guide the pistons they must necessarily be square with the crankshaft. This is originally held to a very close tolerance by the engine manufacturer and in reconditioning a block the mechanic must set up his boring bar and hone to retain this alignment.

Set boring bar to bottom of cylinder.

In boring it has been found best to first carefully clean all scale and carbon from the top of the block with a large mill file. Then using a boring plate or removing the head studs, put the boring bar into place, and run the bar down into the cylinder so that the cat paws can be centered below the ring travel (Figure 1). Here the original alignment has been maintained because there is seldom more than .002 or .003 wear.

One cut

Only one boring cut need be taken except when jumping to a large oversize or when installing a dry sleeve.

Keep boring tool sharp.

Resharpen the cutting tool frequently, carefully, and to the angles recommended by the boring bar maker in order to leave the cylinder surface open rather than burnished or glazed. For this cut, the setting of the tool should be to a diameter .001 less than the oversize stamped on the new pistons.

Allow .001 for honing.

The .001 allowance is for removing the boring tool serrations and improving the cylinder finish. This is easily accomplished with a cylinder hone (Figure 2, next page). Either a dry hone with suction equipment or merely the hone wet with kerosene will be satisfactory for this operation. For the wet operation the oil holes in the crankshaft journals and the end clearance of the main bearings must be taped closed. The grit of the hone stones should be in the neighborhood of 280.

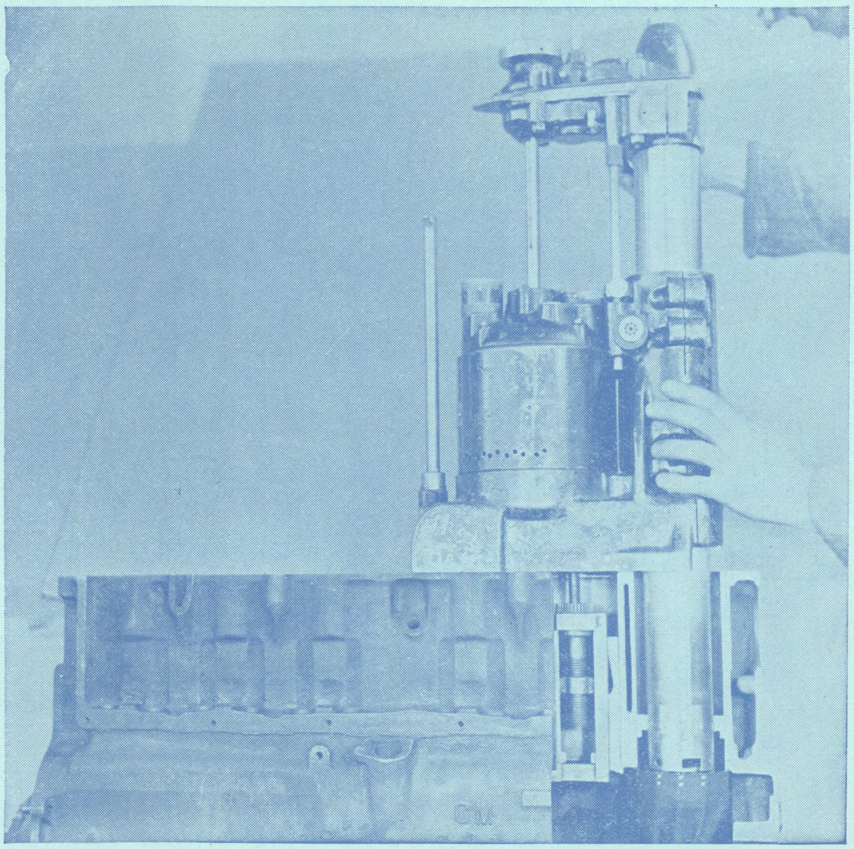


Figure 1

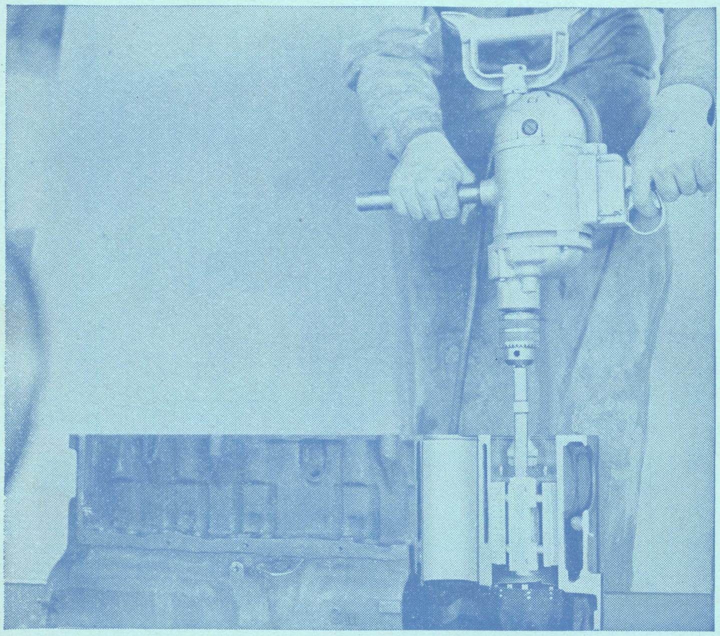


Figure 2

Finish with 280 grit stones.

Using 280 grit stones and keeping the hone cutting free will produce a cylinder finish as shown in the microphotograph (Figure 3). This finish compares very favorably with the original factory finish or that of a McQuay-Norris wet sleeve, as shown in Figure 4. Neither one will cause excessive wear of new piston rings, but will hold an oil film and gently seat in the ring faces so that a seal of oil and blowby will be maintained right from the start.

Thorough cleaning essential.

The honing is followed with a cleaning operation. No better method than the use of hot water and a strong soap has been found. All loose particles of metal and grit must be washed out of the cylinder bore and all recesses of the block so that the new oil will not become contaminated and cause abrasive wear of the rings and other parts.

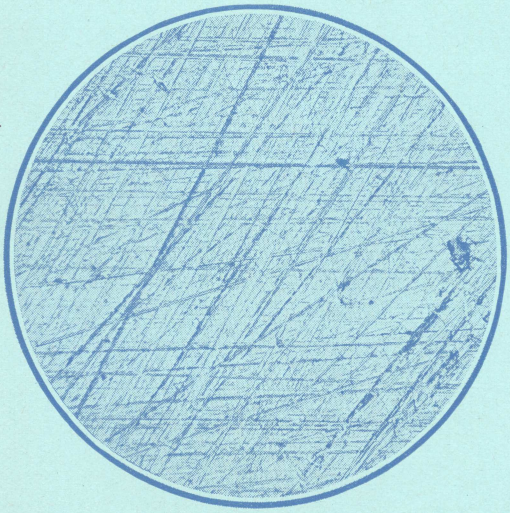
Deglaze when not reboring.

When the cylinders are not being rebored it is still very beneficial to use a 280 grit hone to condition the surface of the cylinder walls for the length of the ring travel. Usually the upper cylinder ledges were removed with a ridge reamer before shoving out the pistons in order to prevent piston land breakage. Therefore it takes only a few strokes of the hone in each cylinder to produce a finish free from glaze or lacquer that will insure seating of the new piston rings.

When reringing a Hudson or Terraplane engine it is absolutely essential to use a hone to remove the vertical ridge left in each cylinder by the travel of the pinned type piston rings. With gaps of the compression rings pinned in a vertical line, if the cylinder ridge is not removed the unworn tips of the new rings will ride this ridge. Such a condition holds the face of the rings away from the cylinder wall, thereby causing blowby and oil consumption.

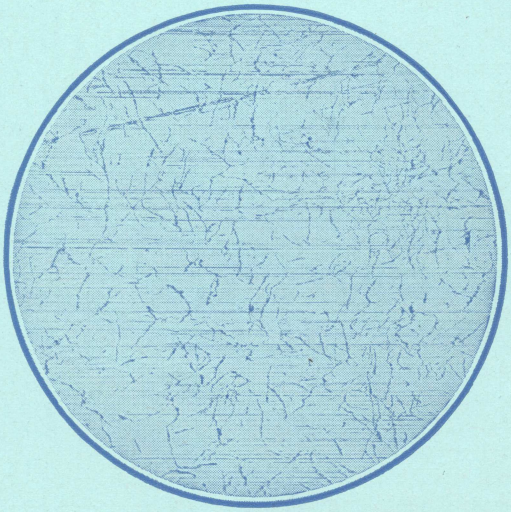
Must clean after deglazing.

During these honing operations, the hone dust and metal particles must be kept out of the other parts of the engine by use of suction equipment or kerosene on the stones. And here again, a thorough cleaning is essential for a good job.



← Fig. 3
BORED - HONED
.001" Finish
(280 grit)
Magnified 65 Times

Fig. 4 →
McQUAY-NORRIS
FACTORY
MACHINE
HONED (Wet)
Magnified 65 Times



CENTER AND INTERMEDIATE MAIN BEARING CHANGE

Bulletin No. 5

Plymouth 1933-41 .... McQ-N. Catalog No. 2520

Dodge 1934-46 **Plymouth & Chrysler** 1942-46 .... McQ-N. Catalog No. 2570

Chrysler & DeSoto 1937-46 .... McQ-N. Catalog No. 2880

Hole in top half only before 1942.

Repairmen servicing engines built by the Chrysler Corporation should take notice of a small change that was made in the center and intermediate main bearings between 1942 and 1946. A 1/4" oil hole was added to the bottom half so both halves are now identical. Before 1942 these bearings, which correspond to McQuay-Norris inserts number 2570, 2520 and 2880, were designed to have the 1/4" oil hole only in the upper half of the insert. The bottom was plain.

Only one hole actually needed.

Of course an oil hole is only needed in the upper half so it will register with the oil hole in the bearing saddle and allow oil under pressure to enter the groove in the main bearing from which it can pass through the drillings in the crankshaft to the adjacent connecting rod journals and so lubricate the rod bearings.

Trouble if bottom half installed o.. top.

When installing the original design of these particular bearings there was always the chance of installing the plain half in the saddle so the oil would be blocked and as a result the main and adjacent rod bearings would be burnt out soon after the job was put back in service. For this reason and no doubt to reduce the number of part numbers, as it is Chrysler's practice to number and pack bearing halves separately, the change was made which is the subject of this bulletin.

Both halves now have hole.

Since the oil hole was added to the lower half in 1942, both halves in new engine bearings and Chrysler replacement bearings for earlier models have been identical even to the part number. All replacement bearing manufacturers have adopted this change and so are furnishing to their distributors two identical bearing halves, each with an oil hole, packed in one box as it is their practice to consider a complete bearing as a bearing number.

Not a packing error.

The point to be made in this bulletin is that by having all distributors and repairmen understand this change on Plymouth, Dodge, Desoto, and Chrysler center and intermediate main bearings corresponding to McQuay-Norris numbers 2520, 2570, and 2880, the present confusion on this subject will be eliminated and such bearings will not be considered mispacked. A 2520, 2570, or 2880, bearing with an oil hole in each half is a correct replacement for both a similar bearing or one with only one-half having an oil hole.

Can't install wrong.

Furthermore, these late type bearings cannot be installed wrong with respect to the oil hole as there is bound to be a bearing hole lined up with the oil pressure hole in the block saddle. Therefore, it is only necessary to see that the lugs in each bearing half fit into the recesses at the parting line between the saddle and the cap.

ENGINEERING DEPARTMENT

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McQUAY-NORRIS SHOP SERVICE

RUN-IN OF REPAIRED ENGINES

Bulletin No. 6

The old saying, "A man's work is never done," certainly has its application to the overhauling of engines. A mechanic may have used good judgment in deciding which worn parts to replace. He may have reconditioned the cylinders thoroughly, cleaned the block, valve chamber, manifold and pan, made certain that the cooling system will operate efficiently, and carefully installed the new parts with the recommended clearances.

But his job is not finished until he sees that the engine is correctly run-in.

Safe oil viscosity.

In order that an oil of safe viscosity be used, it is best to rely on the car manufacturer's recommendation. Do not use too thin an oil. Be sure that the kind of oil used has a good viscosity index, meaning that the oil changes its viscosity relatively little with changes in temperature. An additive may be beneficial, so long as it does not dilute the body of the regular oil.

Naturally, the bearing surfaces of the new parts will generate more than normal heat from friction until they are mated. This excess heat must be dissipated to the atmosphere by either the radiator cooling system or the oiling system, so they both must be in good working order.

Run in with oil level above normal.

In addition, a practice to be highly recommended is that of raising the oil level in the crankcase enough above normal so that the connecting rod caps will dip and throw plenty of oil up into the cylinders and inside of the pistons where it will pick up heat. (See Fig. 1.) The hot oil in falling back into the crankcase will mechanically move this dangerous excess heat of friction away from the pistons, rings and cylinder walls, thereby preventing scuffing and scoring. Also it will provide protective lubrication during the critical period.

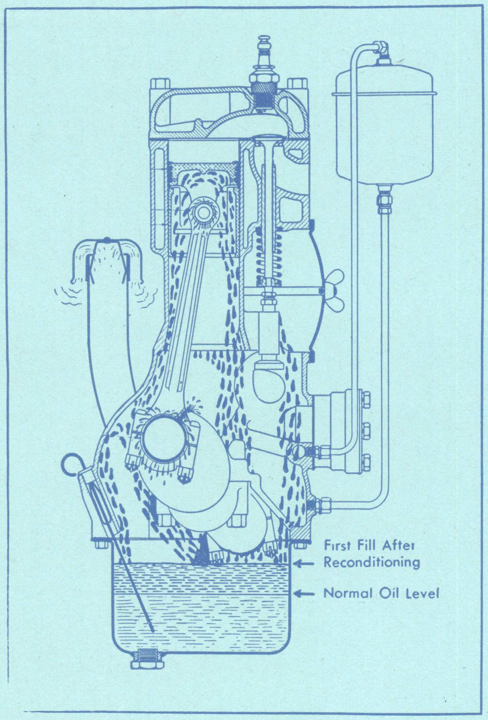

Fig. 1

Furthermore, this first crankcase fill above the normal level will give the inside of the engine a quick wash down, so that any abrasives remaining from the cleaning operation, plus metal particles worn off during the run-in period, will be gathered into the crankcase. Since the fine particles will remain suspended in the oil, this first oil fill should be drained at the first opportunity between 50 and 200 miles on the repaired engine. So much for the oil.

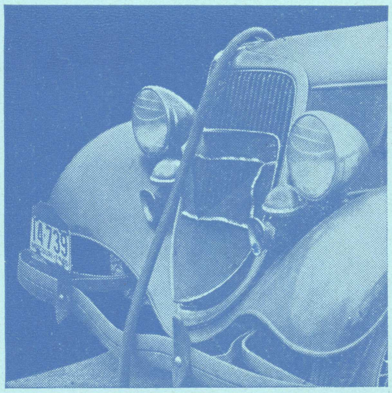

Fig. 2

Do not idle.

When the engine is started up for the first time, do not idle for tune-up. Make only minor adjustments until the engine is running free. Right from the start have the throttle pulled out so the R.P.M. of the motor is high enough to maintain normal oil pressure and get some fan action.

Drive at 25 to 45 m.p.h. from start.

It is best to drive the car after a short warm-up in order to get the full cooling effect of the fan and the car in motion. Any engine will boil and is apt to score the pistons if allowed to run for any length of time with the car standing still. An engine put up with the proper fits and clearance will give no trouble when run between 25 and 45 m.p.h. right from the start.

The only exception to the above procedure is where dynamometer or special equipment is available to furnish sufficient coolant, not cold, but at a regulated 140° to 180° F. temperature, to prevent overheating during run-in.

Under no circumstances should a hose be put into the radiator and cold water continually run through the cooling system. (See Fig. 2.) This would only increase the chances of scoring by keeping the cylinders cold and small while the pistons heat up and expand.

ENGINEERING DEPARTMENT

ST. LOUIS 10, MO., U. S. A.

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BACK CLEARANCE GAUGE

Bulletin No. 7

Exclusive Gauge Design

The Back Clearance Gauge of exclusive design furnished by McQuay-Norris distributors determines for the repairman that the expanders with the new rings he has purchased will have the correct space within which to operate. There are two Back Clearance Gauges:— one for measuring grooves in pistons up to 4″; the other for pistons over 4″.

Why Gauge Needed

McQuay-Norris Leak-Proof and Rebore-Rebuild rings have been so carefully engineered for each make and model of engine that were it not for excessive variation in the groove depth of some standard size pistons and for several different practices of handling oversize piston castings, the gauge would always show the correct back clearance.

Use of Gauge Detects Incorrect Groove Depths

Only in the occasional job will the back clearance gauge show incorrect groove depths that must be changed. By detecting these few jobs and avoiding trouble cases, the time for using the gauge is more than justified. By checking every job and correcting the few exceptions, a good mechanic is certain to turn out only good ring jobs.

How to Use Gauge

A clear, precise instruction sheet is supplied with each back clearance gauge and is printed below (figure 1) to show how easily the gauge can be used.

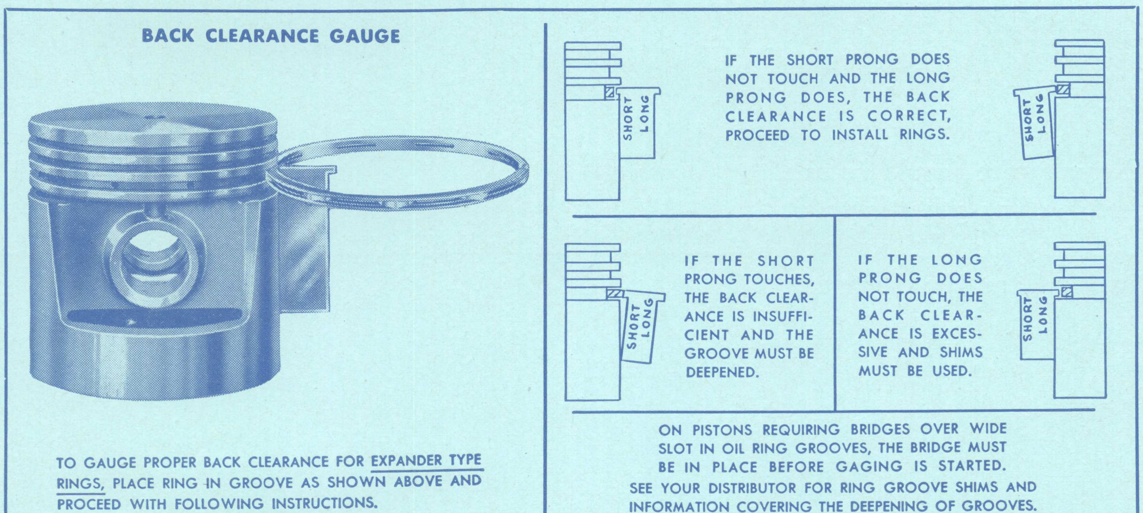

Figure 1.

Recommendations for correcting deep or shallow grooves will be found on the next page.

TIME TESTED McQUAY-NORRIS AUTO PARTS PROVEN IN SERVICE

Ring Groove Shims for Deep Grooves

McQuay-Norris distributors will stock the sizes of shim material required to service all makes and types of pistons that have deep grooves. All sizes of ring groove shims have the same .015 thickness. A set of shims of this thickness will bring practically all deep grooves within the range on the back clearance gauge. Only a very rare case will need two shims in each deep groove.

Tool for Deepening Shallow Grooves

When shallow grooves are encountered, the necessary deepening can be readily accomplished by using a special sturdy groove cutting tool such as the A. D. I. Groove-Rite, which does not require removal of the connecting rod (see figure 2).

Any available lathe will also perform this deepening operation.

Do Not Damage Sides of Piston Grooves

Extreme care should be exercised in using either method so that the sides of the piston grooves will not be damaged.

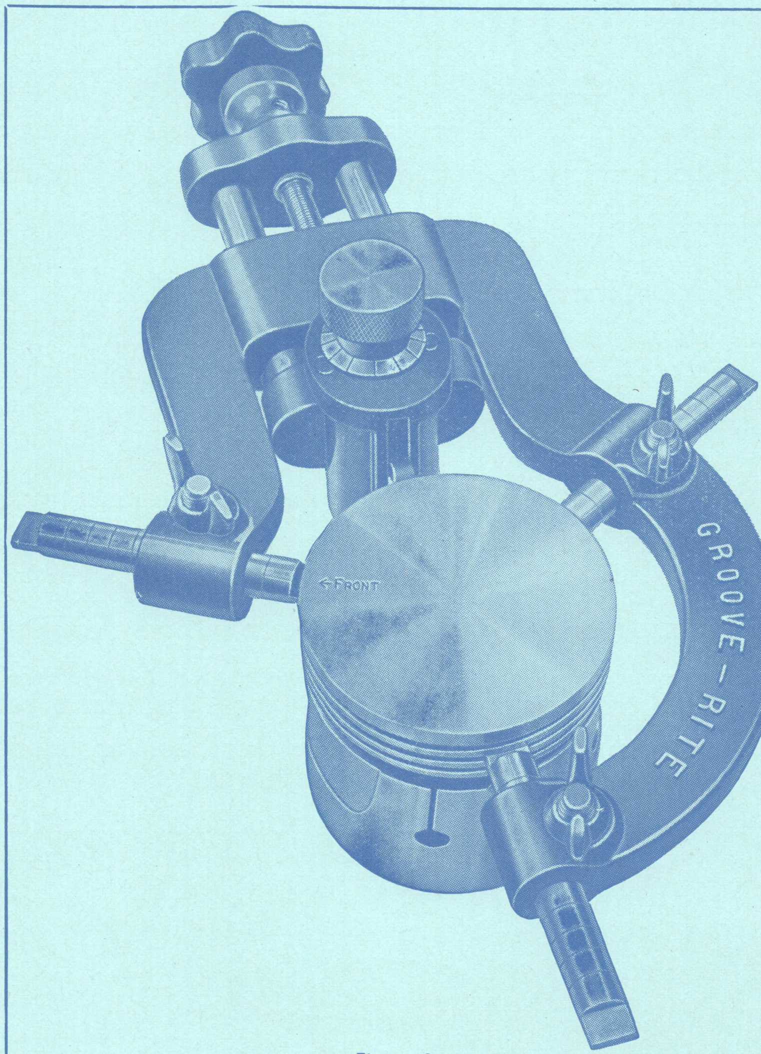

Figure 2.

McQUAY-NORRIS SHOP SERVICE

"M" AND "R" MARKINGS ON 1947 PLYMOUTH CRANKSHAFTS

Bulletin No. 8

.001 Bearing Clearance by Selective Fitting.

Since May 1947 the steel-backed babbitt-lined insert bearings in new Plymouth engines have been selective fit to the main and connecting rod journals of the crankshaft so that the clearance for the oil film is more nearly .001 than the .002 used in the past. This new practice gives the car owner a quieter running engine and longer bearing life but to the repairman it means that any one engine contains some standard and some .001 undersize inserts and journals.

Code of Identification.

A code of identification was worked out and put into operation by the Plymouth engineers to keep the repairmen straight on this change. If the bearing used to obtain the closer fit is standard in size it is not identified. But if the bearing used is a .001 undersize, the machined surface of the center counterweight on the crankshaft is stamped in the following manner.

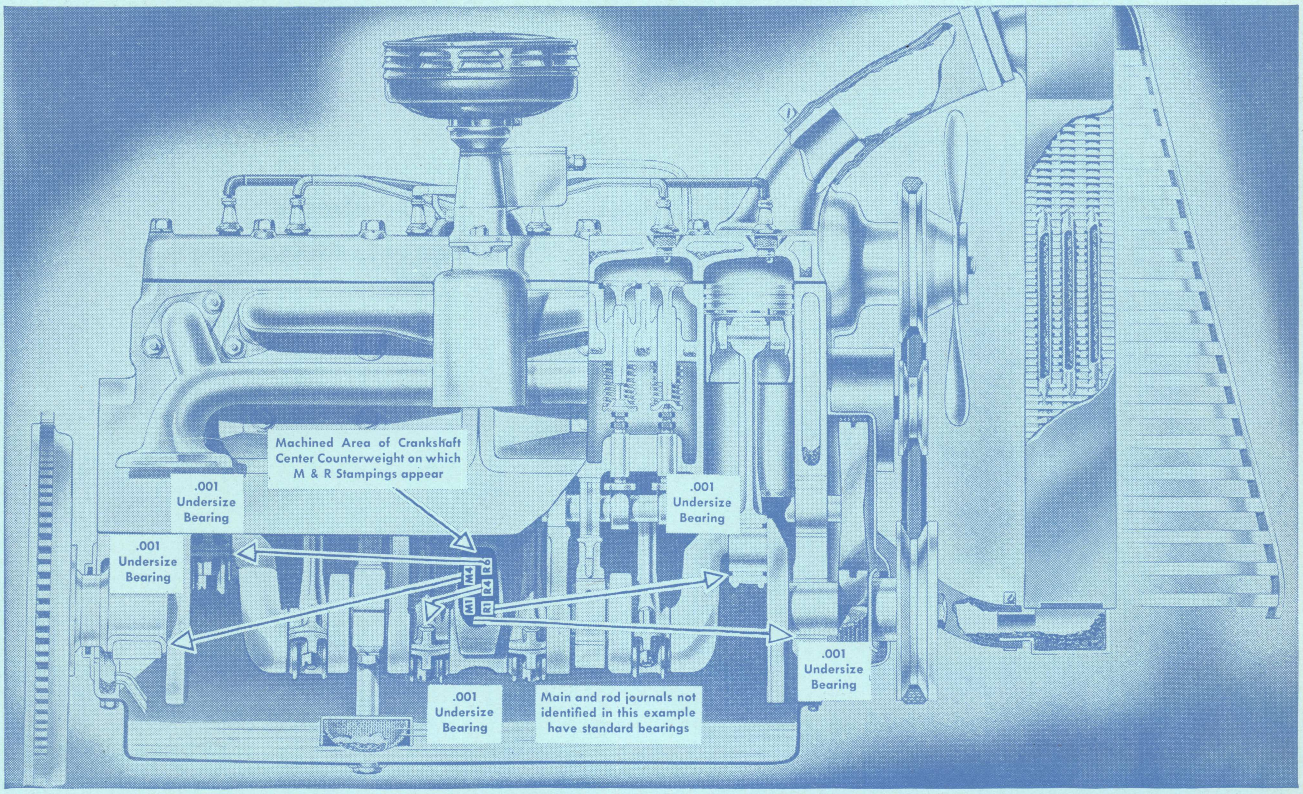

Figure 1

Meaning of "M" and "R".

Bearing Numbering System.

Example.

The capital letter "M" designates "main bearing" and the capital letter "R" designates "connecting rod bearing." (See Fig. 1 above). Starting at the front of the engine the bearing locations are numbered 1, 2, 3, and 4 for the mains and 1, 2, 3, 4, 5, and 6 for the rods. A new engine having .001 undersize front and rear main bearings will have M_1 and M_4 stamped on the center counterweight of the crankshaft. If this engine also has .001 undersize bearings in the first, fourth and sixth connecting rods then the stampings R_1, R_4, and R_6 will appear with the M_1 and M_4.

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Use Proportionally Larger Undersize Replacement Inserts.

It is obvious that the journals of the new crankshafts vary in diameter as much as .001. Now that the bearings are selective fit the engines will have the best possible start since it can be assumed that the journals were ground round and straight. As the car is used the wear on the different journals should be uniform so when enough mileage has been built up on the engine to require replacement of the piston rings and bearings along with a valve grind job, the repairman should be able to install a proportionally larger undersize bearing on the M and R journals than on the originally standard ones. The journals also gradually wear out-of-round and tapered so that on the second or third bearing replacement it will be necessary to regrind the crankshaft or put in a new one.

Bearing Work is Precision Job.

A moment spent in reflection on the meaning of this new bearing fitting practice of such an outstandingly modern car manufacturer can lend a general moral to this bulletin. Bearing fitting must certainly be a precision job if quieter operation and longer life result from reducing the oil clearance from .002 to .001 and from eliminating variation in that clearance by going to the trouble of selective fitting. Does it not follow that a repairman's job on a used engine should be done with the same precision to obtain the same quiet operation and long life from replacement bearing inserts. These desired results can only be realized when the repairman has relatively round, straight and smooth journals and saddles to start with and has accurate tools such as micrometers to work with.

Regrind or Replace Badly Worn Shafts.

It should be understood that once a crankshaft has worn so the journals are .0015 or more out-of-round and tapered, no installation of bearings will hold up for a normal mileage. If such a job is tried instead of having the crankshaft reground or replaced, the poorly fit bearings rapidly pound out and oil throw off increases until even if there is no complaint of noisy bearings there will be one of oil consumption due to the piston rings being flooded with oil.

TIME TESTED McQUAY-NORRIS AUTO PARTS PROVEN IN SERVICE

McQUAY-NORRIS SHOP SERVICE

TIME TESTED McQUAY-NORRIS AUTO PARTS PROVEN IN SERVICE

VALVE SPRING DESIGN AND LOADING

Bulletin No. 9

Valve Spring Design Prevents Breakage

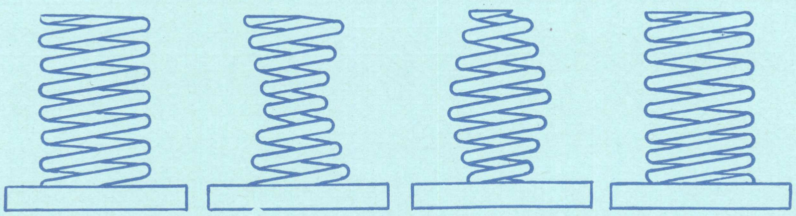
Valve spring design has progressed to the point where failure due to breakage very seldom occurs and such cases are usually traceable to hydrogen embrittlement of the steel caused by corrosion or rusting.

However valve springs will fail to perform efficiently if they have become weak through long usage, have been distorted in installation or have been put in up-side-down. Taking the last condition first it is necessary to recognize the many different spring designs. Each of the different designs illustrated in figure 1 below was originated for a specific engine to overcome breakage by varying the diameter and pitch of the spring coils thereby dampening out vibration and surging which are the principal cause of overstress and fatigue failure. Therefore they must be installed as shown with the more tightly wrapped coils toward the valve head and away from the keeper.

Five Types of Valve Springs

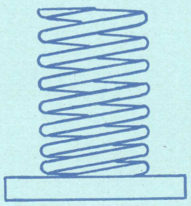
CORRECT INSTALLATION OF VARIOUS TYPES OF VALVE SPRINGS

1.



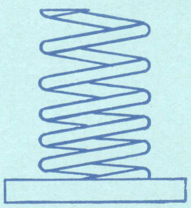
Valve springs having a uniform pitch and those which are symetric on each side of the center can be installed with either end toward the head or block.

2.



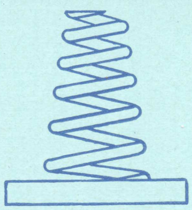
Valve springs which have two or more coils tightly wrapped at one end in order to reduce the tendency for the spring to surge and break in service, must be installed with the heavy end which has the coils closer together against the block or head.

3.



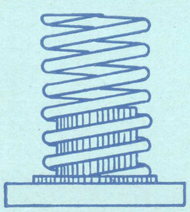
Variable pitch springs. The spacing between the coils of some valve springs gradually increases from one end of the spring to the other. This variation in pitch dampens out vibration and surging. These springs must be installed with the more closely spaced coils toward the head or block. This will place the widely spaced coils toward the moving end of the spring.

4.



Tapered coils with or without variable pitch. These springs are installed with the largest diameter end toward the block or head. This type cannot be installed incorrectly because only the small end will fit the keeper.

5.



Uniform pitch spring with damper. Springs having uniform pitch which are supplied with a damper to fit inside at one end of the spring, may be installed with either end toward the block or head but the damper must always be in the end placed against the block or head. There are several applications using one spring inside another as a damper.

FIGURE I

ENGINEERING DEPARTMENT

ST. LOUIS 10, MO., U. S. A.

Printed in U. S. A.

McQUAY-NORRIS SHOP SERVICE

TIME TESTED McQUAY-NORRIS AUTO PARTS PROVEN IN SERVICE

Deformed Springs Cause Trouble

A valve spring is made to support a definite load when compressed to a certain length. Should the springs in removal, installation or adjustment be pried crooked or the coils compressed solid, such a high stress will be reached in the spring steel that it will be permanently deformed.

A deformed spring will either be too weak to close the valve fast enough or will cause binding of the valve stem in the guide. Such damaged springs should be discarded.

Weak Springs Cause Sluggish Motor and Valve Burning

High driving speeds and long usage cause a gradual weakening of valve spring. In their weakened condition they literally are lazy about closing the valve so that the engine performs sluggish and inefficiently. Furthermore weak springs will not close the valve with tight enough contact against the water cooled seat to get good heat transfer so that valve burning will be the final result.

Test and Replace Weak Springs

Consequently when an engine is overhauled and the valves ground it is smart judgment to replace the old valve springs if they test much below the load specified in the following table.

Loads and Lengths of McQuay-Norris Valve Springs

NUMERICAL LIST OF VALVE SPRING LOADS AND LENGTHS

Stock No.	Free Length	Test At		Stock No.	Free Length	Test At		Stock No.	Free Length	Test At		Stock No.	Free Length	Test At	
		Length	Load			Length	Load			Length	Load			Length	Load
VS-8	3 17/32	2 13/32	64–71	VS-167	3 7/16	2 3/8	70–76	VS-248	2 7/16	1 29/32	49–55	VS-310	2 41/64	2 11/64	40–48
VS-11	3 1/2	3	37–43	VS-174	2 1/2	2 1/16	25–31	VS-249	2 9/16	2 1/4	40–46	VS-311	2 61/64	2 1/2	60–70
VS-15	4 9/16	3 3/4	67–72	VS-175	2 3/4	2 5/32	40–46	VS-250	3 1/16	2 3/8	39–44	VS-312	2 19/32	2 7/32	29–35
VS-16	3 3/4	3 1/4	49–54	VS-176	3 5/8	2 5/8	45	VS-251	2 3/16	1 15/16	35–40	VS-313	2 9/16	1 13/16	20–26
VS-17	3	2 3/8	40–46	VS-177	3 3/4	2 3/16	65–70	VS-252	1 31/32	1 13/16	10–15	VS-314	2 37/64	2 1/4	40–48
VS-18	2 3/8	2 1/8	16–22	VS-179	5 1/16	3	60–75	VS-253	1 7/8	1 21/32	20–25	VS-315	2 7/16	2	55–63
VS-36	4 27/32	4 3/8	50–57	VS-180	3 25/64	2 49/64	54–64	VS-254	2 1/16	1 3/4	44–49	VS-316	2 9/32	2	16–22
VS-39	3 1/4	2 11/16	40–45	VS-181	2 15/16	2 9/16	38–42	VS-257	2 17/32	1 13/16	77–83	VS-319	2 11/32	1 29/32	53–59
VS-40	2 5/8	2 9/32	40–44	VS-182	4 5/16	3 1/4	36–41	VS-258	2 7/16	2	14–18	VS-320	3 5/16	2 3/4	49–55
VS-41	2 3/8	2	36–40	VS-183	2 15/16	2	30–34	VS-260	2 21/32	2 1/4	14–18	VS-321	2 9/32	1 29/32	32–40
VS-46	2 1/4	1 1/2	72–78	VS-184	3 1/8	2 11/16	44–50	VS-261	2 19/32	2 3/8	54–58	VS-322	2 19/32	2 1/4	47–54
VS-59	4 1/2	3 1/16	68–78	VS-185	3 5/16	2 1/8	35–41	VS-262	1 15/16	1 21/32	43–46	VS-324	2 7/16	2	65–70
VS-60	3 23/32	2 7/8	33–39	VS-186	3 7/8	2 5/8	45–52	VS-264	4 1/32	3 13/32	81–89	VS-325	2 3/8	2 3/64	26–30
VS-63	3 9/16	2 7/16	50–55	VS-187	3 5/32	2 3/8	45–55	VS-265	2 15/32	2 1/16	41–46	VS-326	1 43/64	1 7/16	14–18
VS-64	3 1/4	2 1/4	24–29	VS-188	3 11/16	2 3/4	47–53	VS-268	2 3/8	2 7/32	16–20	VS-327	2	1 5/8	43–51
VS-65	2 5/16	1 15/16	38–44	VS-190	3 19/64	2 1/4	16–22	VS-269	2 7/32	1 3/4	37–43	VS-328	1 1/2	1 1/8	21–23
VS-66	1 7/8	1 11/16	15–21	VS-194	1 29/32	1 1/2	9–13	VS-270	2 11/32	2	37–43	VS-329	2 1/16	1 21/32	17–20
VS-69	2 5/16	1 15/16	36–40	VS-195	3 3/16	2 3/16	30–34	VS-271	2 23/32	2 3/8	38–45				
VS-70	2 1/2	1 5/8	39–43	VS-196	4 1/16	2 1/2	85–90	VS-273	2 9/16	1 53/64	29–34	VS-330	2 7/16	2 1/16	45–49
VS-74	3 1/16	1 7/8	52–60	VS-198	3 7/8	2 3/8	22–26	VS-276	2 31/32	2 3/32	39 1/2	VS-331	3 31/64	2 11/16	76–84
VS-79	2 3/4	2 1/32	48–53	VS-200	3 1/2	2 11/16	29–33	VS-277	4 1/4	3 3/8	58–72	VS-332	3 3/64	2 3/8	37–43
VS-82	2 5/8	2 3/16	47–52	VS-204	2 31/64	2 3/16	45–49	VS-278	3 29/32	2 3/4	36–44	VS-333	2 17/32	2 1/16	78–86
VS-83	4 1/4	2 7/8	50–55	VS-205	3 1/8	2 3/8	39–45	VS-279S	2 3/16	1 3/4	33–39	VS-334R	2 1/8	1.821	52–59
VS-89	2 3/4	2 1/4	54–59	VS-206	2 7/8	2 3/32	39–44	VS-281	3 1/2	2	36–40	VS-335	1 27/32	1 5/8	48–53
VS-90	2 19/32	2 7/32	20–25	VS-208	2 15/16	2 1/2	28–34	VS-282	2 7/16	1 15/16	44–49	VS-336	2 41/64	2 1/4	47–54
VS-91	3 1/2	2 15/16	70–79	VS-209	2 23/32	2	98–108	VS-283	2 27/32	2 1/32	82–87	VS-337	3 1/32	2 1/32	99–107
VS-96	3 5/16	2 3/4	50–55	VS-210	3 7/8	3 1/8	53–59	VS-284	2 19/32	2 9/32	43–50	VS-338	4	3 3/8	56–68
VS-97	2 3/4	1 13/16	35–42	VS-211	4 5/8	3 29/32	70	VS-285	2 3/16	1 7/8	42–48	VS-339	2	1 3/4	25–30
VS-100	3	2 5/8	27–32	VS-212	2 3/4	2 3/8	29–34	VS-286	2 9/16	2 7/32	51–51	VS-340	2 5/16	1 7/8	45–51
VS-103	2 5/32	1 3/4	32–37	VS-213	2 21/32	2 3/8	45	VS-287	2 15/32	2	65–70	VS-341	2 25/64	2 1/32	52–58
VS-110	3 5/8	3 1/16	55–60	VS-217	3 11/32	2 5/8	61–67	VS-288	2 5/16	1 7/8	40–46	VS-342	2 5/16	1 13/16	37–43
VS-122	2 7/8	2 1/4	40–46	VS-219	2 9/16	2 1/4	41–48	VS-289	1 7/8	1 13/32	19–23	VS-343	2 13/32	2 1/8	51–57
VS-126	2 5/16	1 15/16	32–38	VS-220	1 31/32	1 21/32	12–18	VS-290	3 3/4	2 13/16	28–34	VS-345	2 1/32	1 3/4	55–61
VS-128	2 9/16	2 1/16	45–50	VS-221	2 7/16	1 15/16	32–38	VS-292	2 1/2	1 3/4	68–72	VS-346	2 1/32	1 21/32	38–42
VS-130	2 9/16	2 1/8	42–46	VS-222	4 5/8	2 1/2	53–59	VS-293	3	2 1/8	58–62	VS-347	2 3/32	1 3/4	37–41
VS-131	2 1/2	2	52–59	VS-223	2 45/64	2 1/4	20–26	VS-294	2 7/8	2 1/32	79–84	VS-348	2 1/32	1 3/4	40–45
VS-132	2 1/2	1 7/8	40–45	VS-226	2 1/2	1 5/8	60–65	VS-295	3 17/32	2 11/16	90–110	VS-349	3 1/2	2 1/2	69–75
VS-135	2 27/32	2 1/2	77–81	VS-231	2 13/16	1 59/64	41–45	VS-296	1 15/16	1 21/32	21–27	VS-351	2 5/16	2	31–37
VS-140	2 5/8	2 1/16	48–52	VS-232	2 17/32	2 5/32	32–38	VS-297	2 1/4	1 15/16	31–36	VS-352	2 3/32	1 3/4	37–41
VS-141	2 1/2	2	47–53	VS-233	2 7/8	2 13/32	38–43	VS-298	1 3/4	1 7/16	19–23	VS-353	2 1/4	1 25/32	31
VS-144	1 11/16	1 1/4	25–29	VS-234	3 9/16	3 1/8	71–79	VS-299	1 15/16	1 21/32	32–35	VS-354	1 29/32	1 21/32	18–22
VS-145	2 1/16	1 13/16	7–13	VS-235	4 5/8	3 3/16	90–110	VS-300	2 7/32	1 59/64	62–69	VS-355	2 11/32	1 15/16	30–34
VS-151	2 3/16	1 15/16	25–30	VS-237	4 1/4	3 9/64	57–64	VS-301	2 29/64	2 3/32	57–62	VS-356	2 1/32	1 3/4	25–28
VS-152	4 1/32	3 1/2	56–61	VS-238	2 59/64	2 7/16	66–74	VS-302	2	1 5/16	30–32	VS-357	3 3/16	2	119-127
VS-157	1 3/4	1 3/8	16–21	VS-239	2 7/32	2	20–26	VS-303	2 7/16	2 3/16	54–60	VS-358	2 1/2	1 3/4	112-120
VS-158	2 1/32	1 11/16	37–42	VS-240	1 21/32	1 9/32	59–67	VS-304	2 23/32	2 1/8	44–52	VS-359	2 1/2	2 1/8	32–36
VS-159	2 11/16	2 1/4	43–49	VS-241	1 21/32	1 9/32	48–54	VS-305	2	1 21/32	42–46	VS-360	2 11/16	1 15/16	37–41
VS-161	2 9/16	2 3/32	59–64	VS-242	2 19/32	2 7/32	32–39	VS-306	2 1/2	2 3/16	50–56	VS-369	1 15/16	1 21/32	45–48
VS-163	3	2 3/8	58–62	VS-243	2 15/16	2 1/2	56–66	VS-307	1 7/8	1 7/16	20–23	VS-370	3 5/16	2 3/4	64–70
VS-164	2 5/16	2	16–22	VS-245	3 3/4	3 1/4	24–32	VS-308	3 7/16	1 15/16	33–37	VS-169R	2 11/32	1 61/64	33–37
VS-166	2 13/16	1 5/8	68–72	VS-246	4 3/16	3 5/8	45–50	VS-309	3 1/2	2 13/32	9–11	VS-170R	2 9/16	2 5/32	54–58

ENGINEERING DEPARTMENT

ST. LOUIS 10, MO., U. S. A.

Printed in U. S. A.

GROOVE FILLER AND GROOVE-RITE TOOL

Service Bulletin No. 10

Top Ring Groove Wear

In reringing a job the condition of the piston and ring grooves is of primary importance. Particularly with aluminum pistons in high compression engines such as Chrysler products and with other types of pistons subjected to dusty operating conditions, the top piston grooves may be found to be worn excessively so they cannot give normal support to new compression rings. This condition must be corrected or the new rings will not only fail to control oil and blowby but the groove condition will get rapidly worse until the lands wear through or break and cause more serious trouble.

When to Rebore

A decision must be made. If during the cleaning operation when the carbon is scraped off and the varnish is removed by washing in carburetor cleaning fluid, any broken lands, cracked skirts, or ruined lock ring grooves are discovered then the most practical decision is to discard the entire set of used pistons, rebore and finish hone the cylinder and install new pistons with McQuay-Norris Rebore-Rebuild piston rings.

When to Rering Using Groove Filler

But when no more than the excessively worn grooves are found, the most economical decision is to recondition the worn grooves, expand the piston skirts, install McQuay-Norris ring Groove Fillers and Leak-Proof piston rings. With the top fire ring grooves squared up and their width reduced to normal by means of the Groove Filler, the expanded pistons will be entirely serviceable. (See instruction sheet on next page.)

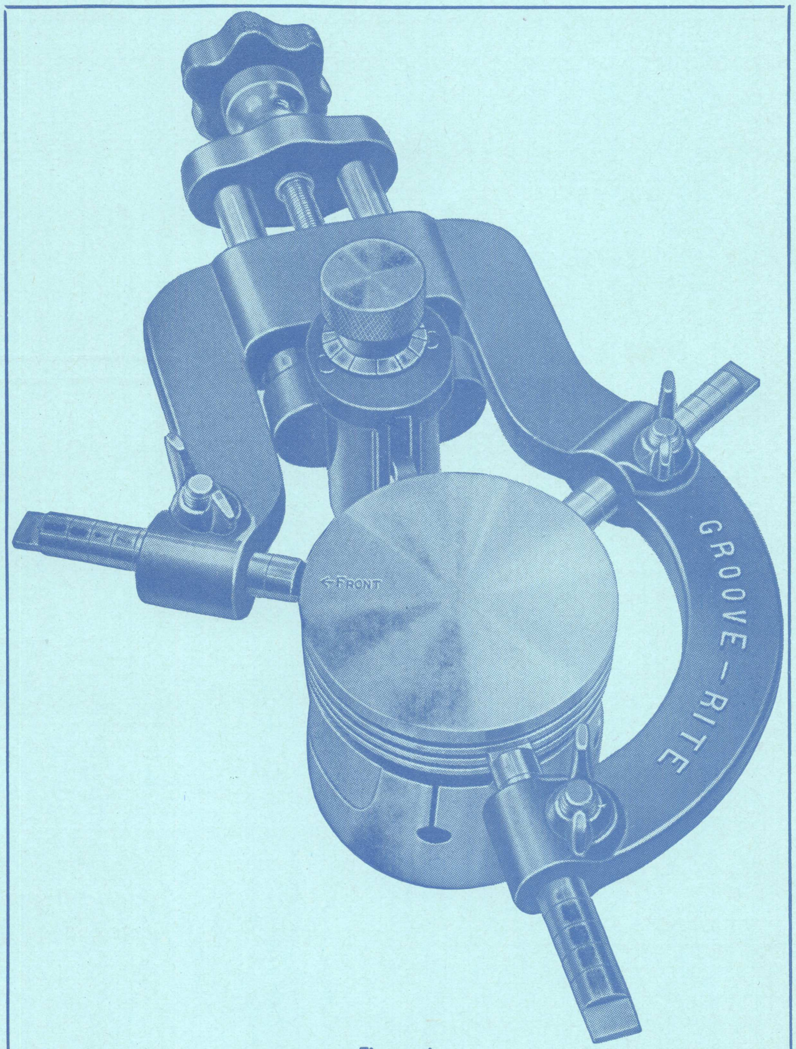


Figure 1.

Tool for Reconditioning Worn Grooves

The best tool for reconditioning worn grooves is the A. D. I. Groove-Rite pictured in figure (1). It is a sturdy precision tool with micrometer cutter adjustment and feed. Its operation is simple and positive as can be seen from the illustration.

The worn grooves can also be remachined in a lathe if one is available.

Advantages of Tool

The advantages of the A. D. I. Groove-Rite tool are that it is portable and it has special cutters to widen the worn grooves just .030″ over the original groove width so they will accommodate a Groove Filler installed above the new compression ring. The side clearance will automatically be correct because sufficient clearance under the original groove width was allowed when the new compression rings were manufactured.

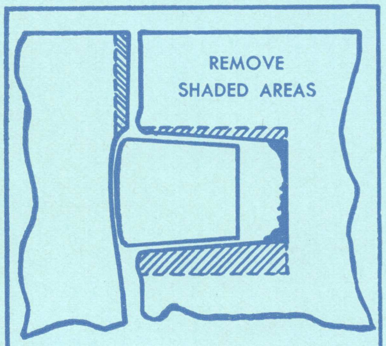
How to Use Tool and Install Groove Filler

Ring Groove Fillers are stocked by McQuay-Norris distributors. Each box of 24 contains the following instruction sheet (figure 2).

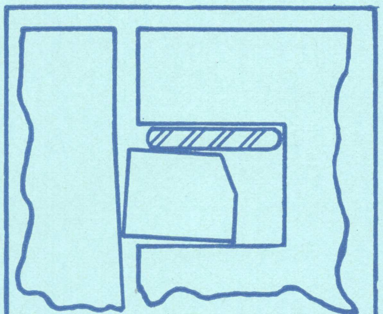
GROOVE FILLER

The Groove Filler is used to reduce the piston groove width to normal where it is necessary to regroove or widen the groove in order to straighten worn sides.

The Groove Filler is furnished in all nominal cylinder diameters with a standard width of .030, and in two thicknesses for each diameter; one to take care of regular grooves and one to take care of deep grooves.



TOP GROOVE BEFORE REGROOVING


TOP GROOVE AFTER REGROOVING AND WITH FILLER IN PLACE

The widening of the groove may be done on a lathe or a special regrooving tool. The amount removed is equal to the width of the Groove Filler. The majority of stock removed should be from the side of the ring groove away from the piston head.

The Groove Filler is a contracting ring. Care must be used in selecting filler so it hugs bottom of groove with a minimum of end clearance and does not project from the groove. It should be installed on the top side of the piston ring.

Figure 2.

DON'T MIX PISTONS AND WET SLEEVES PURCHASED IN ASSEMBLIES

Bulletin No. 11

A wet sleeve is the entire cylinder wall. The cylinder head gasket bearing on the flange of the sleeve seals the top and either rubber or asbestos packing rings seal the bottom so that a tight interference fit is unnecessary.

By using this design in engines normally receiving hard continuous service like trucks and tractors, the manufacturer provides the means for numerous renewals of cylinders and pistons. Furthermore, these parts can be finished, fitted, and packed in assemblies at the parts factory much more accurately and economically.

It must be understood, however, that the pistons and sleeves are selective fit at the factory meaning that pistons on the high limit of the manufacturing tolerance are matched with the sleeves which finish honed on the high limit of the sleeve tolerance. The same for pistons and sleeves having "mean" dimensions for fit and also for pistons and sleeves on the low limit of the tolerance. The fit is checked by placing between the piston and sleeve, a ½" wide strip of feeler stock as thick as the desired clearance. A small spring scale is attached, and the pounds pull required to draw out the feeler must be within an allowable limit.

As a result, the piston clearance is the same in all assemblies of any one model but the dimension of the sleeve bore and piston skirt will vary slightly from one assembly to another.

The foregoing explains why it is imperative for a repairman to keep the parts of each assembly together. If the pistons and sleeves in a set of assemblies for an overhaul job are mixed up during installation, it is very likely that a large piston will end up in a small sleeve bore, and have possibly half the normal operating clearance. Such conditions produce cases of scoring even though the repairman and owner of the equipment are careful in all other respects.

It might be thought that the parts manufacturer could easily put enough identification on these matched piston and sleeve assemblies to prevent mixing. This would be easy if sleeve assemblies were not so heavy that it is impractical to pack them in sets for 4 and 6 cylinder engines.

Each sleeve assembly is packed in an individual carton. The identification appearing on the McQuay-Norris assemblies is a code letter A, B, C, D, or AA stamped in the top edge of the sleeve which designates the size of the sleeve within the manufacturing tolerance, and is stamped on when the sleeves are graded. In any set of 4 or 6 sleeve assemblies furnished by McQuay-Norris or a distributor to a repairman, there may be several assemblies with the same code letter. Consequently, it is extremely important for the repairman to use a square edged mill file to notch the outside edge of the sleeve flange and the inside edge of the piston skirt of an assembly with the same number of notches. Doing this, when the assemblies are unpacked, will prevent the possibility of mixup.

For example, notch the piston and sleeve of the first assembly with one notch, the piston and sleeve of the second assembly with two notches, the third with three notches, and so on through the entire set that is to be installed. Number stamps can be used if available.

With the above insurance against getting the wrong piston into the wrong sleeve, you can proceed to install the sleeves. Make a special effort to clean all rust, sealing compound and packing ring material out of the opening in the block so the new sleeves will slip into place without distortion. The piston clearance will then be correct for the full length of the cylinder.

LATE BUICK PISTONS REQUIRE .012 CAM RELIEF

Bulletin No. 12

Starting with 1938, the Buick Motor Company has used raised (Turbulator and Fireball) head aluminum pistons in their 3-3/32 and 3-7/16″ bore engines.

Cast Struts

The head and skirt of this piston design are connected to the pin bosses by two thick straight aluminum struts perpendicular to the pin hole. These struts blend into the skirt at four points which are approximately 45° in each direction from the pin hole.

Rigidity of Skirt Requires More Cam Clearance

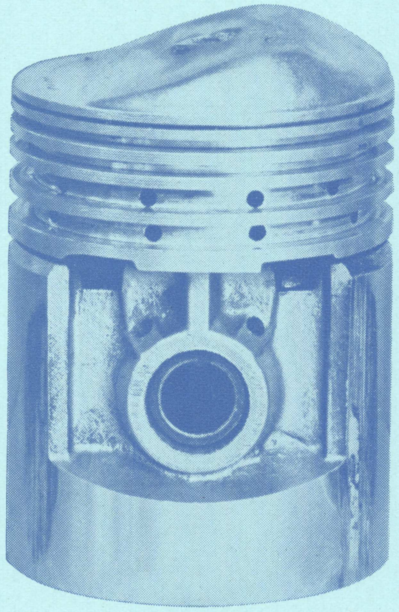


Figure 1

In addition to making the piston strong and effective in transferring heat away from the head, these struts unfortunately reduce the flexibility of the skirt which has no slot through the bottom half. The resulting rigidity at the 45° points makes these Buick pistons susceptible to scoring, (See Figure 1). Therefore more cam relief at the critical 45° points is now recommended as a factor of safety against scoring.

Use Cam "D"

The above applies to McQuay-Norris pistons Nos. P-290A, P-291A, P-314A and P-315A. In finish grinding use standard cam "D" which produces a .012 smaller diameter in line with the pin hole than across the thrust surfaces. (See Figure 2). The shape of cam "D" is hollowed out at the 45° critical points to a .010 smaller diameter than across the thrust surfaces. This affords .005 clearance at each of the four critical points for expansion of the skirt and struts over and above the skirt-to-cylinder wall clearance.

Pistons P-290A and P-291A are the Turbulator type having a T-slot and require .00175 skirt clearance. Pistons P-314A and P-315A are the Fireball type having two transverse slots and require .00225 skirt clearance.

Positive Taper

Set the cam grinding machine to taper the skirt so it is .0005 larger at the bottom.

Chamfer Top Edge Skirt

Furthermore, the top edge of the skirt should be chamfered 1/32″ at a 20° angle to the vertical as a further precaution against scuffing.

Use Instruction Sheet No. 35

All McQuay-Norris factories and branches have been following the above specifications since December, 1946, so that for about a year now all pistons finished to size have been ground to cam "D" and all semi-finished pistons P-290A, P-291A, P-314A and P-315A have been packed with a new instruction sheet No. 35 calling for cam "D".

This bulletin is written because there are still some piston grinders in the field who are following the original specifications.

From now on be sure that shopmen use cam "D" on raised head Buick pistons, allowing .00175 skirt clearance for the T-slot type and .00225 for the double transverse slot type.

STANDARD CAM **D**

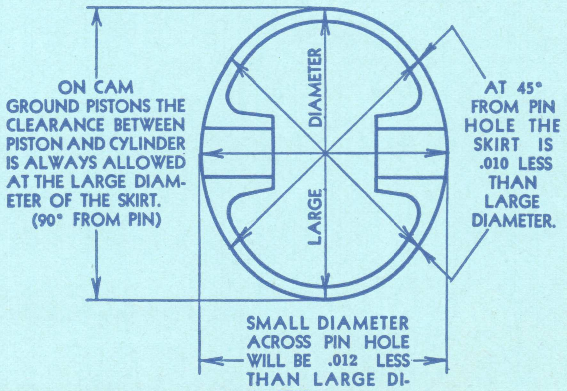


Figure 2

ENGINEERING DEPARTMENT

ST. LOUIS 10, MO., U. S. A.

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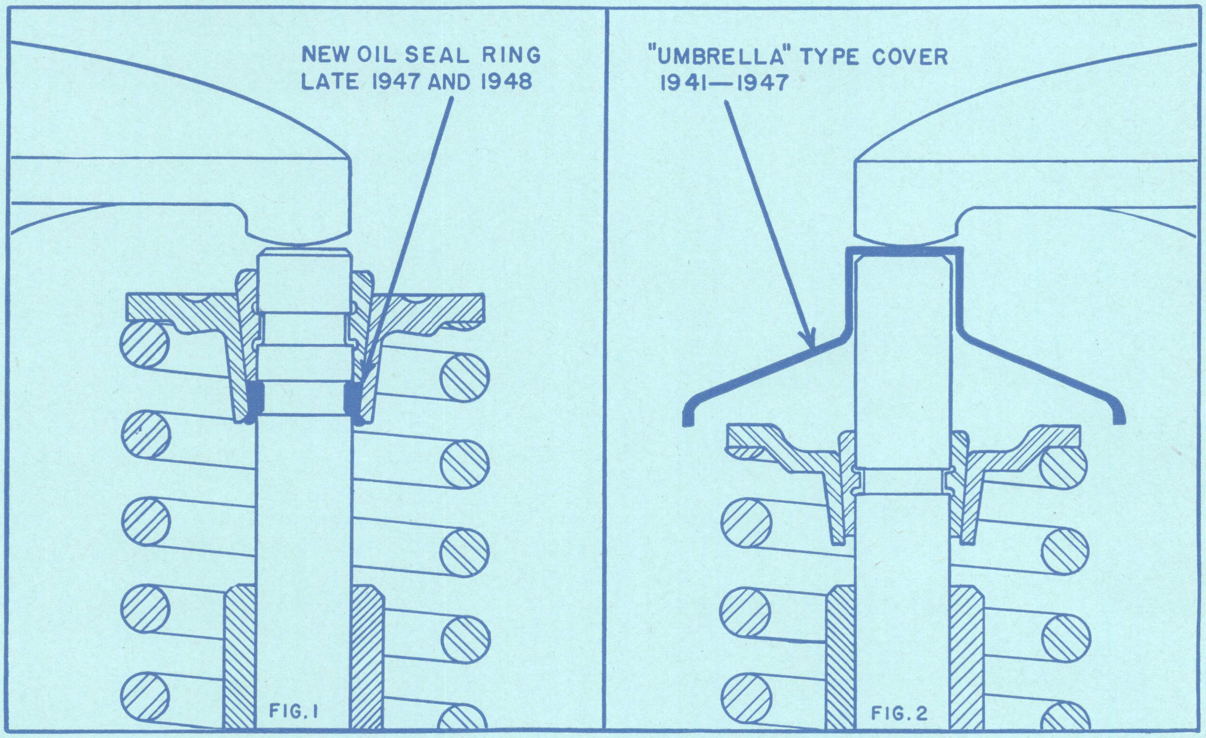
CHEVROLET SYNTHETIC RUBBER VALVE STEM SEALS

Bulletin No. 13

Late in 1947, Chevrolet started using a synthetic rubber valve seal ring in their production of 3½″ and $3\frac{9}{16}$″ bore engines. The new seal ring (Figure 1) is Chevrolet part number 3835333, and fits both the intake and exhaust valves. It takes the place of the valve spring cap cover or "Umbrella" (Figure 2) which became original equipment back in 1941 to prevent oil from getting across the rocker arms and running down the valve stems, then being sucked past the guides into the ports and finally exiting with the exhaust.



However, in order to accommodate the new seal ring which goes ahead of the keeper and between the stem and cap, it was necessary to make changes in the design of the valve stem and valve spring cap (Study Figure 1).

The new valves are Chevrolet part number 3835318 for the exhaust, and part number 3835319 for the intake. They are the same as the now common valves number 839412 exhaust and number 839504 intake, except for a second groove in the stem to hold the seal ring and also a longer stem to compensate for elimination of the spring cap cover or "Umbrella." The new stem lengths are 4¾″ for the exhaust and 5½″ for the intake from end of stem to top of valve face.

The tapered hole in the valve spring cap had to be lengthened to extend over the seal ring in the new stem groove so a new cap design was necessary.

Chevrolet engineers took this opportunity to make both the exhaust and intake caps the same. The new part number is 3835392 and can be identified by a $\frac{1}{16}$″ deep groove around the top of the cap. It takes the place of exhaust cap number 2136335 and intake cap number 839367.

No change has been made in the split key, spring, guide, or the rocker arm assembly.

In 1941, when Chevrolet engineers recognized the need for "Umbrellas" to prevent oil consumption past valve guides of their overhead valve engine, they adopted the valve cap cover. The present 1947 change is an improvement and simplification which all repairmen will welcome as it denotes progress.

As this new valve oil seal ring comes into use, McQuay-Norris will furnish the seal as Part No. M678 and the corresponding exhaust valve number V-1365 and intake valve number V-1366N. Should valves of the new design need replacement and the new type are not on hand, it is entirely satisfactory to use the shorter single groove exhaust valve V-1308, and intake V-1309, so long as the companionate spring cap and cap cover are also used.

ENGINEERING DEPARTMENT

ST. LOUIS 10, MO., U. S. A.

Printed in U. S. A.

PREVENTION OF ABRASIVE WEAR

Bulletin No. 14

Of the three basic causes of motor parts deterioration, abrasion, corrosion and erosion, the most destructive is abrasion. Therefore, abrasive wear can be considered Destructive Enemy No. 1 to long and efficient parts life.

An internal combustion engine has a definite analogy in the functioning of the human body. Both transform fuel into energy and heat. They must be supplied with large quantities of clean air to burn the fuel efficiently and to carry off the waste products. A normal operating temperature must be maintained by a cooling or respiratory system. With a reasonable amount of care and an occasional tune-up, both will give wonderful service.

The human body and the internal combustion engine are remarkable mechanisms. However, they cannot stand up under continual abuse or neglect. The air they breathe and the fuel they consume must be clean.

An outstanding example of accelerated destruction of human life and motor life is the story of the dust storms. But the destructive action of atmospheric dust in an internal combustion engine operating even under average country or city driving conditions is not fully realized by the average motorist and repairman. The dust in a city or country atmosphere may not be prevalent to the degree that it is in a dust storm, but even a small amount of dust has a very detrimental effect once it gets into an engine.

Regardless of where a vehicle is operated, the life of its parts will be shortened if the engine is not protected by an efficient air cleaner. Few persons realize that even in an industrial area there is a large amount of dust and abrasive material in the atmosphere. It has been determined that approximately four tons per day of dirt settle on every square mile of such an area.

With this in mind, consider the air requirements of a normal sized automotive engine. To burn one gallon of gasoline efficiently, this engine must draw into the cylinders through the carburetor and intake manifold close to 1000 cubic feet of air.

As a result, if the engine is not protected by an efficient air cleaner, there are certain to be between 100 and 750 grams of dust inhaled every 10,000 miles. This dust plays havoc with the cylinders, pistons and rings. Destruction of motor life due to this cause can usually be identified by examining the affected parts. The top compression ring and piston groove will be the most severely worn. Since less dust will work its way down to the second, third and fourth rings, they will be worn proportionately less. (See figure 1.)

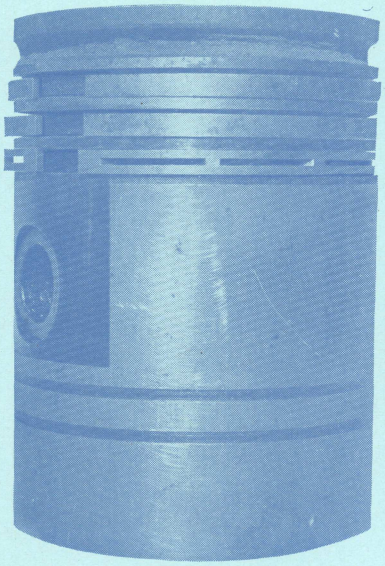


Figure 1

To prevent such a condition from developing in your engines, install one of the better oil bath air cleaners and see that it is properly serviced. More frequent attention is necessary when the atmosphere is particularly dusty. When servicing an oil bath air cleaner, never fill with oil above the specified level because too much oil will retard the flow of air. As a result, a rich fuel mixture will reach the cylinders. Although there will be no dust, the rich fuel mixture will cause the type of wear known as erosion due to dilution of the protective oil film on the cylinder wall.

It must also be mentioned that abrasive particles may enter a crankcase with the ventilating air. Therefore it is sometimes necessary to alter the ventilating system when an engine is working in heavy dust.

Whenever you take an engine apart for repairs, thoroughly clean out all accumulation of grit and sludge. However, the cleaning operation should be the final one before assembly, because no shop is free from dust. If the cleaning is done too soon the engine will accumulate enough dust and grit before being reassembled to cause rapid wear which will take 5,000 to 10,000 miles from the life of the parts.

If the cylinders are refinished, the boring operation should be followed with a 280 grit hone which should be allowed to cut freely by the liberal use of kerosene. By obtaining a smooth finish, followed by cleaning out all metal particles and hone abrasive by scrubbing with soap and hot water, you make certain that the new piston rings will seat but not partially wear themselves out polishing the cylinder walls.

If the valves are to be ground, this work should be done before any attempt is made to clean the block. After reseating the block with either reamers or hard seat grinders and possibly grinding in the refaced valves, direct an air hose into the carburetor vent tube and blow air through the intake manifold while the crankshaft is turned over to open the intake valves successively. This will blow all cuttings, hard carbon and abrasives out of the valve ports. If this is not done, these foreign particles will be drawn into the cylinders with the first charge of fuel when the motor is again started.

After all the intended repairs have been made on the engine, the piston assemblies and motor block should be cleaned. The cylinder block, crankcase, pan and valve chamber should be scrubbed with hot water containing a strong soap. Of course, any of the accepted commercial cleaners are satisfactory. It is necessary only that the cleaning solution cut the grease and lacquer formations which hold the abrasive particles in the pores of the cylinder bores and in the out-of-the-way places in the crankcase and valve chamber. Once the foreign particles, which may include core sand, metal cuttings, cylinder hone or valve grinding grit, hard carbon and dirt are free, the best rinsing agent is hot water.

Next the excess water can be blown away and the oil lines blown out. After the cylinder bores, etc., have been wiped off with a clean rag, the piston assemblies should be installed at once.

By replacing the oil filter or cartridge before the new oil is put into the clean motor, the new oil will not be contaminated due to dissolving lacquers or varnishes out of the filter or motor.

ENGINEERING DEPARTMENT
ST. LOUIS 10, MO., U. S. A.

Printed in U. S. A.

TIME TESTED McQUAY-NORRIS AUTO PARTS PROVEN IN SERVICE

McQUAY-NORRIS SHOP SERVICE

TIME TESTED McQUAY-NORRIS AUTO PARTS PROVEN IN SERVICE

NOW "S" AND "OS" TYPE CHEVROLET PISTONS

Bulletin No. 15

P-384AX and P-390AX 3½″ Diameter Aluminum Pistons

P-1184X, P-1204X, P-1260X and P-1261X 3½″ Diameter Iron Pistons

P-1263X 3-9/16″ Diameter Iron Pistons

The above McQuay-Norris pistons for Chevrolet engines have now joined the ranks of the "S" and "OS" type Ford, Plymouth, Dodge and Chrysler pistons.

In the early period of the automobile business, the car factories as well as the independent piston makers used one semifinished piston for standard and all oversizes. This meant that the diameter of the ring groove was set so that a proper ring groove would exist on a standard piston. Once this was determined all semifinished pistons were given the same ring groove diameter regardless of whether they were to be finished in standard or the various oversizes.

Under the circumstances a .020 oversize piston would have a groove depth .010 deeper than standard; a .040 oversize piston would have a groove depth .020 deeper than standard; similarly the groove depth of a .060 oversize piston was .030 deeper than standard.

In the past, ring manufacturers had little or no trouble designing piston rings to fit the oversize pistons with greater groove depth. In the case of factory type rings without springs, groove depth was not too important. With spring type rings the thickness of the ring and expander and the other ring specifications could be altered to conform to the groove depth.

About 15 years ago Ford became conscious of some of the benefits that could be developed in their aluminum piston castings by changing the diameter of the inside of the piston as well as the diameter of the ring grooves in the larger oversizes. The volume was so tremendous that the additional cost of dies and machining was negligible.

A few years ago Chrysler decided to use a larger diameter core and a larger diameter piston ring groove on their larger oversizes for replacement service. Here again a sufficient volume enabled them to have two semifinished pistons for the range of oversizes.

As soon as Ford and Chrysler adopted the practice of using several semifinished types of piston for replacement service, McQuay-Norris followed with the "S" and "OS" pistons for certain Ford and Chrysler pistons, to follow more closely the car factory's practice.

While Chevrolet furnishes only finished pistons for the replacement trade, they now make the finished pistons from two types of semifinished casting. One type has a ring groove diameter correct for the standard cylinder and is used for all sizes from standard up to and including .020 oversize. This is our "S" type semifinished piston.

The .030, .040 and .060 oversize finished pistons are made from another semifinished piston, having a larger ring groove diameter, which compensates for the large increase in groove depth common to the old practice. This is our "OS" type semifinished piston.

McQuay-Norris, beginning November 1, 1947, started to produce the seven Chevrolet pistons from "S" and "OS" type semifinished pistons. Our "S" type semifinished pistons are made with a ring groove diameter which is constant for all finished pistons from standard to and including .020 oversize. The "OS" piston for these numbers has a larger ring groove diameter and is used for all pistons that are finished at .025 to and including .060 oversize.

ENGINEERING DEPARTMENT
ST. LOUIS 10, MO., U. S. A.

McQUAY-NORRIS SHOP SERVICE

CHEVROLET PISTONS WITH CONSTANT GROOVE DIAMETERS FOR ALL OVERSIZES USED BY ALL INDEPENDENT PISTON MAKERS AND FORMERLY USED BY McQUAY-NORRIS.

CHEVROLET PISTONS WITH VARIABLE GROOVE DIAMETERS FOR ALL OVERSIZES AS USED BY CHEVROLET FACTORY AND McQUAY-NORRIS FROM HERE ON.

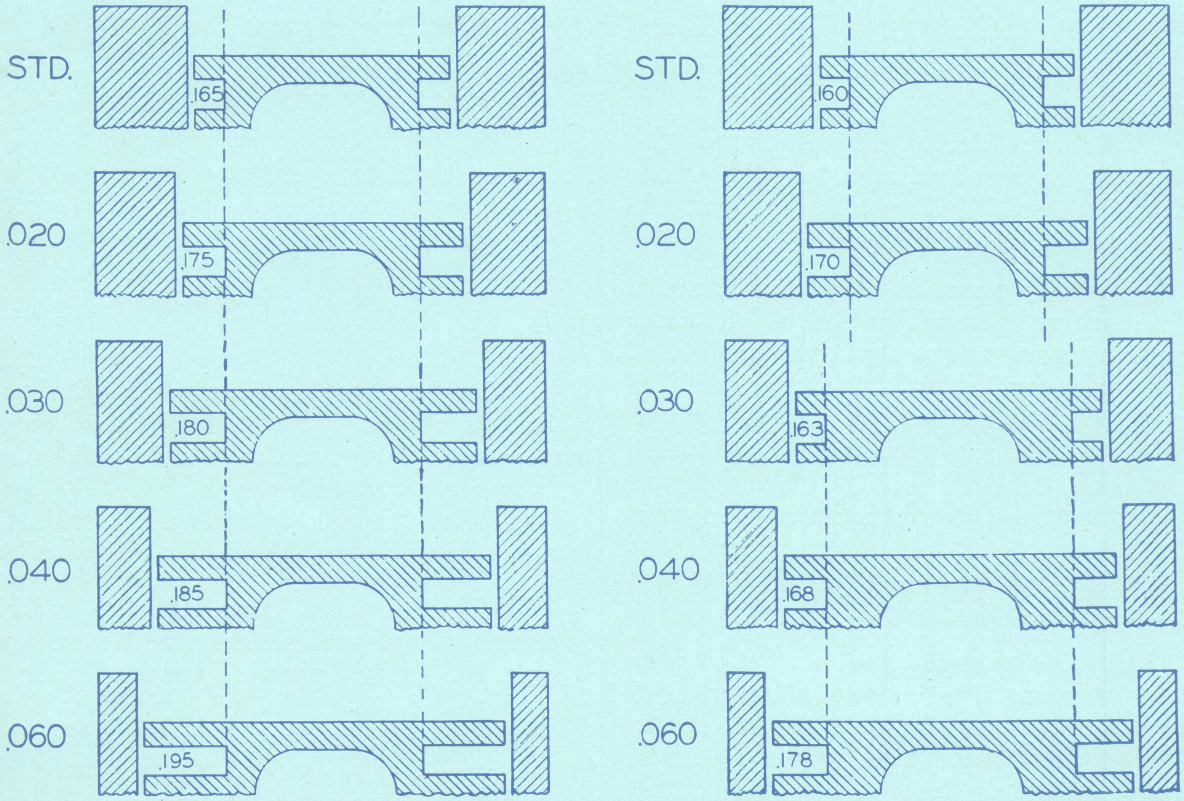


Figure 1

The chart in Fig. 1 shows an example of both the old plan and the new plan. On the left hand side we have shown a small section of the cylinders and pistons of five oversizes that are serviced with the semifinished piston having one groove diameter. This was the system used by Chevrolet prior to their recent change and is still used by all independent piston makers. It is the plan that we used up to November 1, 1947. The dotted vertical lines show that all oversize pistons have the same ring groove diameter and the figures in the ring grooves show the variation in depth of the groove as we increase the oversize.

On the right hand side of the chart we show five sections of cylinders and pistons indicating the five most popular sizes. Here we show with the vertical dotted lines the use of two semifinished pistons, one having the same ring groove diameter for standard up to and including .020 and the other having a larger ring groove diameter for .030 to and including .060 oversize.

You will note the ring groove depth variation where two types of semifinished pistons are used is not nearly so extreme as it is when one semifinished piston is used. By comparing the figures directly shown in the ring grooves for each oversize you will see the difference.

The question now arises as to what effect this will have on piston ring sets. McQuay-Norris piston ring sets, including the spring ring sets, are always engineered **to first fit properly the car factory pistons.** The next step that McQuay-Norris takes is to see that our pistons follow the car factory's practice as closely as possible. With this change in Chevrolet pistons, our replacement piston groove depths will duplicate those of the Chevrolet factory. As a result, McQuay-Norris ring sets will fit the Chevrolet piston and our piston in the same manner because we have actually planned it that way.

Each box of pistons going out under the new plan will have a caution sheet which is almost identical to that used in explaining the "S" and "OS" Ford and Chrysler pistons. Our jobbing accounts, engine rebuilders and dealers should be familiar with the reason for the "S" and "OS" semifinished pistons and their application, since we have been doing it for over 15 years on certain Ford pistons and for a number of years on Chrysler.

It clearly states that the "S" type semifinished piston should be used for pistons standard to and including .020 oversize. It states that the "OS" type should be used for pistons .025 and up. It also states that smaller oversize pistons should not be finished from the "OS" type semifinished pistons because the ring groove depth would be too shallow.

ENGINEERING DEPARTMENT

ST. LOUIS 10, MO., U. S. A.

Printed in U. S. A.

TORQUE WRENCH SPECIFICATIONS FOR PASSENGER CAR AND TRUCK ENGINES

Bulletin No. 16

A few years ago it was conclusively proven that uniform tightening of engine bolts and nuts to the torque recommended by the engine manufacturer greatly reduces and often eliminates troublesome distortion. Reducing cylinder bore distortion to a minimum results in lower blowby and oil consumption. Control of blowby means more efficient operation and usually longer life from piston assemblies. Many times piston rings and pistons have failed to give satisfactory performance or have even scored because of cylinder distortion. Furthermore, water is prevented from leaking past the cylinder head gasket by uniform tightening of the cylinder head.

It also follows that since the cylinder bores are distorted by uneven tightening of the cylinder head, the valve chambers either in the overhead valve type of engine or the "L" head engine will be distorted to the extent that the valves cannot seat. This results in burning of the valve faces and sometimes the seats.

The tightening of connecting rod bolts and main bearings with a torque wrench gives bearings a much better opportunity to function normally and eliminates the chance of stretched or stripped bolts causing serious damage.

Intake and exhaust manifold nuts, top water connection casting and other importantly located nuts on the engine should likewise be tightened uniformly with a torque wrench to prevent cracking and insure best results.

Beyond the decided advantage of using a torque indicating wrench instead of an ordinary wrench on important nuts and bolts, it must constantly be kept in mind that the desired results will not be produced unless the threads are turning freely. If part of the tightening force is absorbed by threads that are binding from lack of lubrication, too tight a thread fit, or distortion of the threads, there may still be uneven pressure between the cylinder head and block, etc.

It is equally important that the force supplied is not being absorbed by the stud nut or the head of the bolt where it contacts the cylinder head. Both the threads and the contact with the cylinder head should be smooth and lubricated. It is advisable to chase the threads on studs to remove any nicks or rust. Nuts as well as the parts being bolted together should be thoroughly cleaned so that a free fit will be obtained and practically all of the tension indicated by the torque wrench will actually be uniformly holding the parts together without distortion.

Remember to tighten cast iron cylinder heads with the engine thoroughly warmed up. Aluminum heads should not be finally tightened down until the engine has been thoroughly warmed up and then allowed to cool.

The starting point and sequence of tightening cylinder head nuts or bolts are equally as important as the correct tension. Generally speaking, all nuts or bolts should be run down snug with a speed wrench. This should be done in two or three steps, running over all studs each time and each time gradually increasing the amount of tightness. Then start using the torque indicating wrench on the center nut or bolt and work to the sides and ends of the head, alternating and criss-crossing.

On the first round draw down to somewhat more than half the specified tension, repeat the process to the full tension. Finish by another round as a double check. In some cases it will be found that as much as a half turn will occur with exactly the same reading on the wrench for the entire half rotation of the stud. This is normal and the stud should be tightened until the reading on the wrench dial starts to indicate a very slight excess of the poundage recommended.

Use one of the several good types of torque wrenches now available, and always use the tensions specified on the following tables. Notice that the tensions are shown in foot pounds, meaning the pounds pull of the mechanic multiplied by the length of the wrench handle in feet from the socket to the mechanic's hand. The foot pounds multiplied by 12 convert tensions to inch pounds.

(See Specified Torques on Reverse Side)

ENGINEERING DEPARTMENT

ST. LOUIS 10, MO., U. S. A.

Printed in U. S. A.

PASSENGER CAR ENGINES TORQUE WRENCH SPECIFICATIONS IN FOOT POUNDS

MAKE	MODELS	YEAR	CYLINDER HEADS Cast Iron	CYLINDER HEADS Aluminum	MOTOR BEARINGS Con. Rod Bear. Bolts	MOTOR BEARINGS Main Bearing Caps	Fly Wheel To Crank-shaft	MANIFOLDS Intake	MANIFOLDS Exhaust	MANIFOLDS Water	SPARK PLUGS Cast Iron Heads	SPARK PLUGS Aluminum Heads	SPARK PLUGS Size
Auburn—Cord	All		49–52	—	—	—	—	—	—	—	—	—	—
Buick	40	Before 1940	65–70	—	45–50	60–65	20–25	25–30	25–30	15–20	12–17	—	14M.M.
"	60	"	65–70	—	60–65	60–65	15–20	25–30	25–30	15–20	12–17	—	14M.M.
"	40-50	1940-1941	65–70	—	45–50	120–130	45–55	25–30	25–30	10–15	25–30	—	14M.M.
"	40-50	1942-1946	65–70	—	45–50	120–130	45–55	25–30	25–30	25–30	22–28	—	14M.M.
"	60-70-80-90	1940-1941	65–70	—	60–65	120–130	45–55	25–30	25–30	10–15	7–10	—	10M.M.
"	60-70-90	1942-1946	65–70	—	60–65	120–130	45–55	25–30	25–30	25–30	22–28	—	10M.M.
Cadillac	V-8	Before 1940	70–75	—	55–60	130–140	65–70	25–30	25–30	70–75	35–40	—	14M.M.
"	V-16	"	70–75	—	55–60	100–110	65–70	25–30	25–30	70–75	7–10	—	10M.M.
"	50-52-62-72-60s-75	1940	70–75	—	55–60	130–140	65–70	25–30	25–30	—	7–10	—	10M.M.
"	90	1940	70–75	—	55–60	100–110	65–70	25–30	25–30	—	7–10	—	10M.M.
"	All	1941	70–75	—	50–60	130–140	65–70	25–30	25–30	—	—	—	—
"	All	1942	70–75	—	50–60	140–150	65–70	25–30	25–30	—	—	—	—
"	All	1946	70–75	—	60–65	130–140	Std. 65–70 Hyd. 70–75	25–30	25–30	—	7–10	—	10M.M.
Chevrolet	All	1939	75–80	—	*40–45	*100–110	*35–40	—	—	—	25–30 12–15	— —	14M.M. 10M.M.
"	All plus 1-2; 3-4; 1½ Ton Trucks	1940-1946	75–80	—	*40–45	*100–110	50–65	—	—	—	12–15	—	10M.M.
Chrysler DeSoto Dodge Plymouth	All	1939–1946	65-70—Cap Screws 55-60—Studs and Nuts		45–50	75–80	55–60	15–20	15–20	25–30	26–30	—	—
Ford	V-60	All	—	25–30	—	—	—	—	—	—	28–32	24–28	—
"	All Others	All	50–60	35–40	35–40	75–80	65–70	—	—	—	24–28	20–24	—
Graham Paige	96–97	1938-1939	45–50	45–50	35–40	90–100	40–45	20–25	20–25		—	—	—
Hudson	6 Cyl.	Before 1940	45	45	52	92	—	—	—	—	27.5	—	14M.M.
"	8 Cyl.	"	54	54	52	92	—	—	—	—	28.5	—	14M.M.
"	6 Cyl.	1940-1941	40–45	—	40–45	55–75	40–50	15–20	20–30	15–20	25–30	—	14M.M.
"	8 Cyl.	"	45–50	—	40–45	55–75	40–50	15–20	20–30	15–20	25–30	—	14M.M.
"	All	1942-1946	6 Cyl.—40	—	40	75	45	15	20	20	28	—	—
			8 Cyl.—50	—	40	75	45	15	20	20	28	—	—
LaSalle	See Cadillac												
Lincoln	All	All	45–50	35–40	—	—	—	—	—	—	28–32	24–28	—
Lincoln Zephyr	All	All	—	35–40	—	—	—	—	—	—	28–32	24–28	—
Mercury	All	All	50–60	35–40	35–40	75–80	65–70	—	—	—	28–32	24–28	—
Nash	10-20-60	All	64	—	56	70	101	—	25	—	—	—	—
"	40	1941	60	—	30	70	56	—	25	—	—	—	—
"	80	All	70	—	56	73	131	—	25	—	—	—	—
"	46-40 "L" Head	1942-1946	57–60	—	27–30	66–70	52–56	—	—	—	25–30	—	14M.M.
" 46-60	Over-Head Valve	1942-1946	65–70	—	52–56	66–70	96–100	—	—	—	25–30	—	14M.M.
Oldsmobile	F, G and L	1939	63–70	—	32–35	x137–144	39–42	11–12	11–12	23–26	28–35	—	14M.M.
"	60-70-80	1940	60–70	—	50–55	z140	40–45	11–14	22–26	22–26	28–35	—	14M.M.
"	6 and 8 Cyl.	1941–1946	60–70	—	50–55	†100	55–60 Hydra.–60	11–14	22–26	22–26	28–35	—	14M.M.
Packard	6 and 8 Cyl.	Before 1942	61	—	60	83	—	—	—	—	—	—	—
"	Super 8	"	61	—	47	68	—	—	—	—	—	—	—
"	6 and 8 Cyl.	1942-1946	60–62	—	45–46	82–85	65–70	25–30	25–30	—	50 Inch Lbs.		
"	Super 8	1942-1946	60–62	—	56–58	82–85	65–70	25–30	25–30	—	50 Inch Lbs.		
Plymouth	See Chrysler												
Pontiac	All	Before 1946	60	—	45	85	6 Cyl-105 8 Cyl-70	—	—	—	—	—	—
"	All	1946	60	—	45	85	100	—	—	—	—	—	—
Studebaker	Champion	Before 1942	50–55	—	25–27	92	—	—	—	—	33–42	—	18M.M.
"	Pres. and Comm.	"	83	—	54	92	—	—	—	—	33–42	—	18M.M.
" "	Champion M5, M15, & M15A Trucks	1942-1946	46–50	—	28–32	88–95	—	—	—	—	—	—	—
" "	President M16 Truck	1942-1936	77–83	—	40–44	88–95	—	—	—	—	—	—	—
Willys-Overland	All	All	65–75 (Screws)		50–55	65–70	—	—	—	—	—	—	—
Willys	All	All	60–65 (Studs)		50–55	65–70	—	—	—	—	—	—	—
Willys-Jeep	C-J-2A	1945-1946	65–75 (Screws) 60–65 (Studs)		50–55	65–70	36–40	31–35	31–35	20–25	—	—	—

Rockerarm Shaft Bolts—Buick 30–35—Chevrolet 25–30—Nash 15–20. *Threads Oiled.
x Front and Rear—Intermediate—118–122. z Front and Rear—Intermediate—120. † Front and Intermediate—Rear 140.
Torque requirements are given in both foot pounds and inch pounds—one foot pound is the same as twelve inch pounds.

TRUCK ENGINES

			Bolt or Stud Diameter	Cylinder Head	Connecting Rods	Main Bearings
General Motors	228, 248			60–65	40–50	70–80
	278, 308			90–100	80–90	90–100
	361, 426, 451			90–100	90–100	90–100
	3-71S, 3-71, 4-71S, 4-71 (Diesel)			135–145	50–55	85–95
Int. Harvester	All Models of Trucks Including Tractors		7'16"	56	56	
			1-2"	67		75
			9'16"			75
			5-8"	93		93
Lycoming	BB, FB, FC, GG, GH, WF	Passenger Cars		49–52.5		
	GFD	Taxi Cabs		49–52.5		
	AFE	Trucks		52.5–56		
	BF	Trucks		49–52.5		
	AEF, ASE	Trucks and Buses		52.5–56		
Reo	S209, S140			58–60.5	49–52.5	87.5–98
	S228, S268, S309—1937-8 Series			83–100	71–75	66.5–75
Mack	AB, AC, AP, BK, BQ			114–119	91–95	137–140
	BG-CU			86–91	74–77	137–140
	CE, CF, CT			109–114	91–95	137–140
	209"			60–61	46–49	84–91
	228, 268, 309			63–65	67–70	63–70
	EJ			63–65	67–70	63–70
Waukesha	FC		7'16"	45–55		
	XAH, VIK, 6ZKA, 6ML, 6MK, 6-110, 6BK, 6SRK, 6-125 XBKH, VBZH, 6BKH, 6D100, CHK, HL, WK, 6GAK, 6RB, HBKH, 6D-80, 6D-140		1-2"	65–80		
	6EK, 6LS, 6LRO, WBFH, 6EKH		5-8"	90–110		
	6NKH, 6LRH		3-4"	100–120		
White	All Models (Recommended Torque for any Application)		3-8"	23–26	23–26	23–26
			7'16"	44–47	44–47	44–47
			1-2"	61–65	61–65	61–65
			9'16"	88–96	88–96	88–96
			5-8"	152–166	152–166	152–166

McQUAY-NORRIS SHOP SERVICE

REPLACING STUDEBAKER CHAMPION PISTON PINS

Bulletin No. 17

A mechanic who has never seen a Studebaker Champion piston pin removed from the rod and piston will very likely be in trouble on his first job and probably break a few pistons getting experience, if he does not carefully study this article.

The Studebaker Champion uses an unconventional pin locking bolt of the wedge type to secure the pin in the rod so it will oscillate only in the piston bosses and have no chance of touching the cylinder wall. Since the small end of the connecting rod is not split, the pin is not pinched as in the more common oscillating pin design used in the Chevrolet motor. Therefore a flat is milled at the center of the pin and the locking bolt is tapered so that it forms a wedge.

Both ends of the locking bolt are threaded and when the repairman disassembles a Champion motor to do a ring, pin or bearing job, the nut and lock washer are tight on the end of the locking bolt which produces the wedging action. (See Fig. 1).

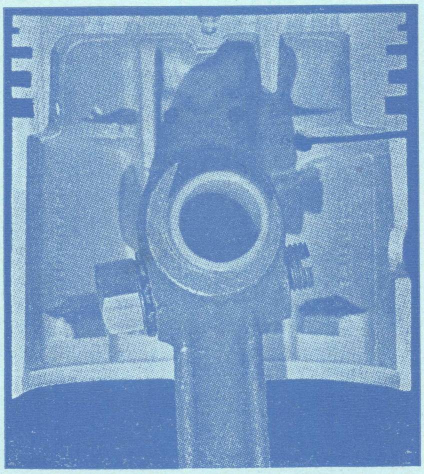


Fig. 1

Consequently the first operation in the removal of the piston pin is to use a 9/16" box socket or end wrench to loosen the nut. Remove the nut and lock washer completely from the pin locking bolt. Then screw the nut on the other end of the bolt, which is the end that is made with a screw driver slot. (See Fig.2). Using the same wrench, continue to tighten the nut. This will break loose the pin locking bolt and back the wedge away from the flat on the piston pin.

The entire works now seems loose enough, but herein is the most important point on which to make a mental note in order that you will not have a broken piston on your hands when you do that first job: THE PISTON PIN CANNOT BE PUSHED OR DRIVEN OUT OF THE PISTON AND ROD UNTIL THE LOOSE PIN LOCKING BOLT HAS BEEN COMPLETELY REMOVED FROM THE ROD.

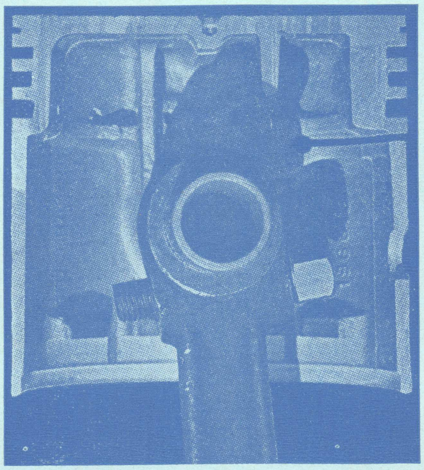


Fig. 2

To remove the loose bolt, first take the nut off of the bolt and then turn the rod with relationship to the piston until the locking bolt can be slipped out through the ⅜" hole in the slotted side of the piston skirt. (See Fig. 3).

After the locking bolt has been removed, the piston pin can easily be pushed out with the correct size drift while holding the piston in the palm of one hand.

As far as pin fitting is concerned, the regular practices prevail. Regarding putting the piston and rod assembly back together, the matter of aligning the flat on the pin with the hole in the rod is most important so that installation of the tapered locking pin can be made without difficulty.

When starting the pin in the first piston boss, face the flat toward the open end of the piston skirt, letting it angle slightly toward the ⅜" hole in the skirt. As the pin passes through the first piston boss, enter it into the rod. Be absolutely sure that the rod has been placed in the piston with the spurt hole in the bearing opposite the T-slot and ⅜" hole in the skirt. Use a pin drift or soft nosed hammer to drive the pin in until it is centered in the piston.

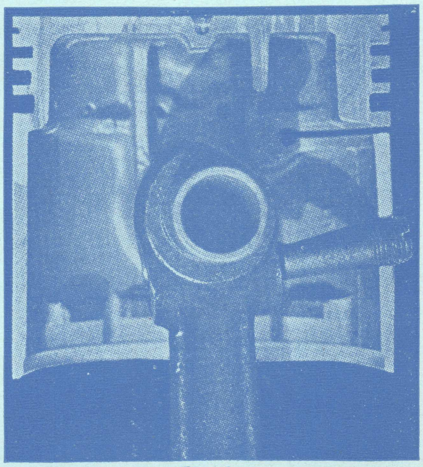


Fig. 3

Again turn the rod with relationship to the piston skirt so the hole in the rod will point at the ⅜" hole in the skirt. It is now time to insert the tapered locking pin through the ⅜" hole in the skirt. The end having the flat side goes in first, with the flat on the bolt facing the flat on the pin. A screw driver will be useful at this point to wiggle the tapered bolt if necessary to get it to slip into place. It is for this reason alone that the rear end of the locking bolt is slotted.

A new lock washer and the nut are now placed on the unslotted end of the tapered locking pin. Gradually tightening the nut with the 9/16" box socket or end wrench will produce the wedging action which securely fastens the pin in the rod.

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ST. LOUIS 10, MO., U. S. A.

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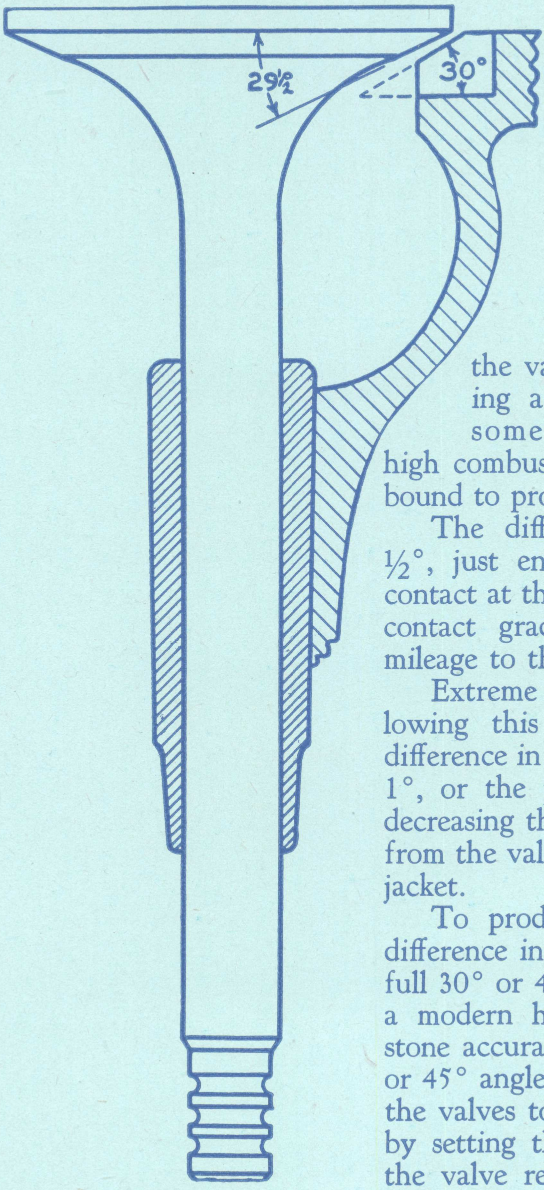
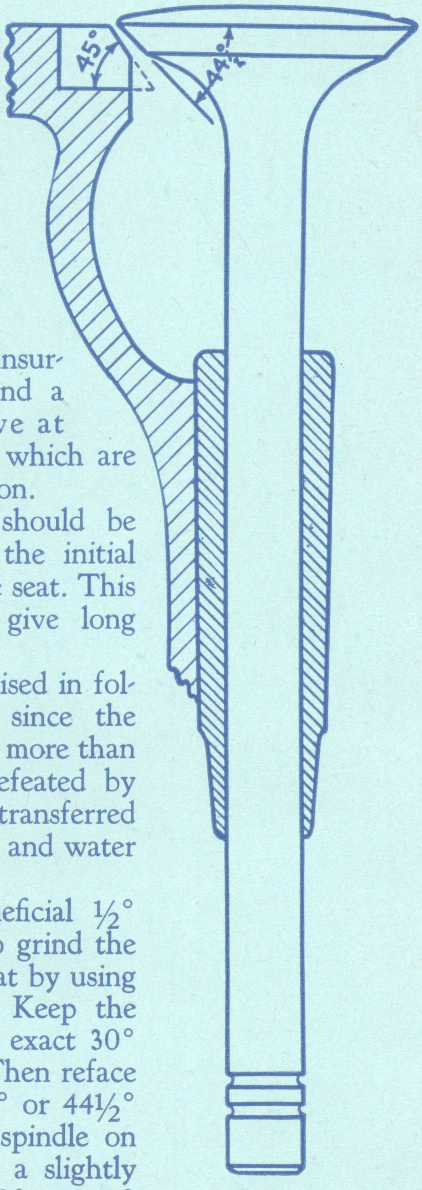
McQUAY-NORRIS SHOP SERVICE

REFACE VALVES ½° TO 1° SMALLER THAN SEAT ANGLE

Bulletin No. 18

Truck engines are being worked harder these days, and due to variations in gasoline quality the operating temperature is often abnormally high. Therefore every possible break must be given to engine parts such as valves. One recommendation that can be made to repairmen is grinding of the valve face angle slightly smaller than the seat angle in the engine block or head. This results in positive initial seating toward the outer edge of the valve face, thereby insuring a better gas seal and a somewhat cooler valve at high combustion temperatures, which are bound to produce some distortion.





The difference in angles should be ½°, just enough to produce the initial contact at the outer edge of the seat. This contact gradually widens to give long mileage to the valve job.

Extreme care must be exercised in following this recommendation, since the difference in angles must not be more than 1°, or the purpose will be defeated by decreasing the amount of heat transferred from the valve head to the seat and water jacket.

To produce the very beneficial ½° difference in angles it is best to grind the full 30° or 45° angle on the seat by using a modern hard seat grinder. Keep the stone accurately dressed to the exact 30° or 45° angle commonly used. Then reface the valves to an angle of 29½° or 44½° by setting the pivoted chuck spindle on the valve refacing machine to a slightly sharper angle than the full 30° or 45° graduation on the carriage.

Be sure there is no run-out on either the finished valve seat or valve face by checking with a dial indicator. Such being the case, there is no need for lapping in the valves with abrasive compound, although a careful mechanic will want to use mechanic's blue or a lead pencil to make certain there is 100° contact of the valve face with the outer edge of the valve seat and a minimum difference in angle.

ENGINEERING DEPARTMENT

ST. LOUIS 10, Mo., U. S. A.

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LEAD COATED COPPER ALLOY BEARINGS FOR FORDS 1949 PRODUCTION

Bulletin No. 19

Copper alloy bearings have been around for quite some time. Although not very handsome looking, they stand up well in hard service so long as plenty of good clean oil is present to prevent shaft wearing and grooving.

Only by keeping the oil clean by use of a good filter and frequent changes combined with thorough cleaning of the lubricating system at the time of the bearing installation, will wear be prevented, since any dirt in the oil will form a lap between the hard crankshaft journals and the hard copper alloy bearing linings.

Grooving of the crankshaft journals results from failure of lubrication. Barring accidental failure or clogged oil lines, the principal cause of grooving is absence of lubrication in the bearings when a new or reconditioned engine is first started up. At this critical time the ordinary copper alloy bearing is hard on the shaft, so that serious damage may occur before the oil pump gets oil circulating. To overcome this hazard of copper alloy bearings, the International Harvester Truck Division started some time ago to coat their copper alloy bearings with a light lead electroplate. This soft lead coating acts as a metal lubricant on the crankshaft journals very similar to the way the highly successful Altinized coating on McQuay-Norris piston rings protects cylinder walls against scuffing.

The repair trade must recognize the purpose and definite benefit of this lead coating on copper alloy bearings and accept the fact that their dull stained appearance is intentional. Several complaints of dull finish have been received, where this latest bearing development has been added to McQuay-Norris bearings for International trucks. With these bearings it is performance, not looks, that counts.

1949 FORD, LINCOLN AND MERCURY TO BE SO EQUIPPED

It is getting around that not only do the Ford, Lincoln and Mercury 1949 model engines have conventional locked type insert rod bearings instead of the floating type used in Ford and Mercury engines for years, but the material is copper alloy on steel backs. The finished bearings are electroplated with a **thin coating of lead** to protect the crankshaft.

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TIME TESTED McQUAY-NORRIS AUTO PARTS PROVEN IN SERVICE

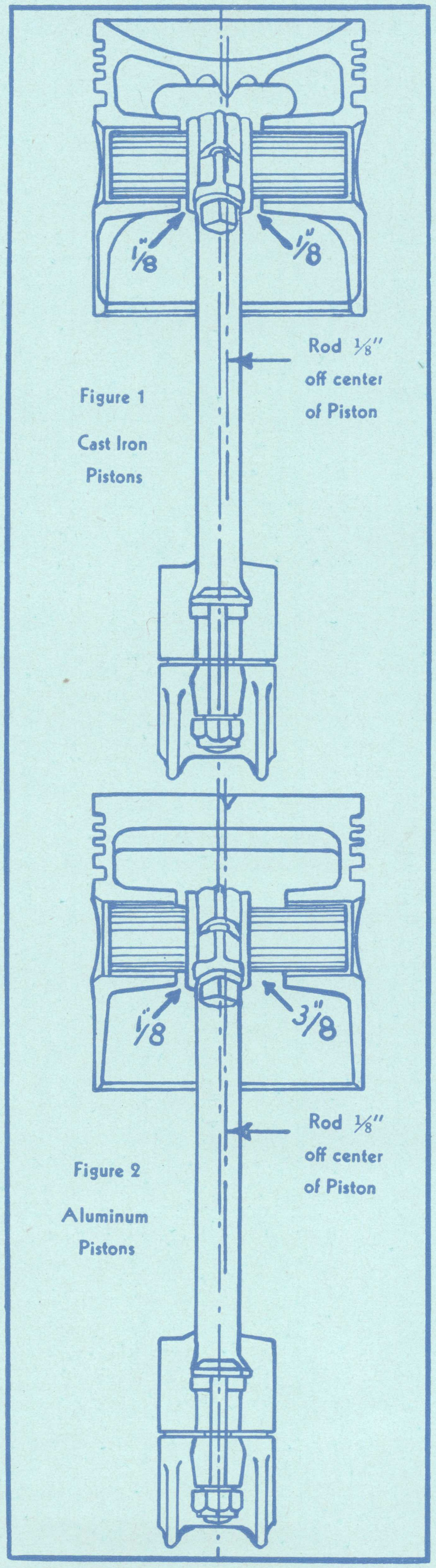

Figure 1 Cast Iron Pistons

Figure 2 Aluminum Pistons

"WC" ALLIS CHALMERS 4" DIAMETER PISTONS

Service Bulletin No. 20

The 4" diameter, four-cylinder Allis Chalmers model WC engine is constructed to give 1/4" more width to the center main bearing and 1/8" more width to the front and rear main bearings by off-setting the connecting rod journals of the crankshaft. In the block assembly this places the small end of the rod 1/8" off the center of the pin length and pin hole in the piston.

From 1933 up until 1947 the cast iron pistons, both concave head, low compression, and flat head, high compression, used in this popular engine were designed with one pin boss 1/4" longer than the other. In these pistons the rods are locked to the pins with the same 1/8" clearance on each side. See Figure 1.

Since 1947 these engines have used an aluminum piston which is designed with both pin bosses the same length, but with the same offset rod condition. This places one side of the rod 1/4" closer to one boss than the other side of the rod is to the other boss. See Figure 2.

It is therefore important for the mechanic replacing pistons in this engine to remember to hold the pin centered in the piston and then offset the rod 1/8" on the pin before tightening the clamping bolt.

The rod for No. 1 cylinder must be offset to the rear of the engine. No. 4 rod is offset toward the front of the engine. No. 2 and No. 3 rods are offset away from the center of the engine.

By watching this point carefully when assembling the rods, pins and pistons, the mechanic will avoid having the rod centered on the pin or offset in the wrong direction, with the result that the rod, when installed on the crankshaft, will move one end of the pin over where it will contact and score the cylinder.

McQUAY-NORRIS SHOP SERVICE

BEARING OIL LEAK TESTER – A USEFUL TOOL

Bulletin No. 21

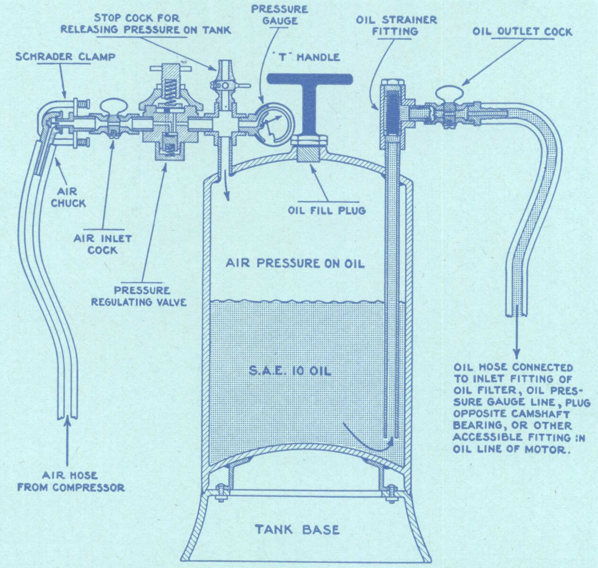

DIAGRAM OF BEARING TESTER

Fig. 1
Diagram of Bearing Tester

The bearing oil leak tester, illustrated in Fig. 1, has many uses in the modern automotive shop. As the name implies, its principal purpose is to put the normal operating oil pressure on a forced feed lubricating system, with the crankcase of the engine removed, so that the amount of oil bleeding from the main, camshaft and connecting rod bearings can be observed. This test provides the most convincing argument to prove that new undersize bearings are required before good oil mileage can be obtained.

But bearing testing is not the only use for this tool. It can be employed to check the oil pressure gauge on the engine. This is done while the bearing test is being run, by merely comparing the reading on the tester gauge with that on the dashboard gauge. Also, any excessive flow of oil back through the oil pump during the bearing test will indicate worn gears and plate. In this way the tester is actually a means of checking the oil pump condition.

After the correct size bearings have been installed, the tester can again be used to see that the entire system is holding pressure. At this time the oil pressure regulating or by-pass valve on the engine can be checked by running up the air pressure in the bearing oil leak tester until it is slightly above the specified pressure that the valve is supposed to hold. If the valve is not sticking and the spring is not too strong, oil should start to by-pass and return to the crankcase. Also, in using the tester, it may be found that the pressure regulator spring is too weak or the valve is sticking open, so that normal oil pressure will not build up in the oil lines of the motor. Cleaning of the valve and installation of a new spring will remedy this condition.

Occasionally scuffing and scoring occurs in Ford V8 engines and the cause, after being blamed on pistons or rings, is finally traced to a faulty oil pressure relief valve maintaining the oil pressure way below normal. Sometimes the replacement of a weak spring and a pitted plunger does not entirely correct the trouble because the seat in the block is also pitted. The seat cannot be replaced since it is an integral part of the block (see Fig. 2) so it must be reconditioned. If a special tool is not available a gool seal can be obtained by centering the new plunger on the seat. Then with a blunt punch held against the end of the plunger deliver a sharp blow with a light hammer. This will pound the plunger face into a good seat which with the new spring will hold the normal oil pressure so that the bearings, cylinders, pistons and rings will be properly lubricated. This operation on the seat is used by many good mechanics.

Engine rebuilders are beginning to use the bearing oil leak tester at the end of their production unit. The purpose is to fill the oil lines and bearings of every rebuilt engine with clean light oil which will be there when any customer installs and starts the engine, thus giving initial lubrication during the few seconds it takes the oil pump to build up pressure and get the crankcase oil flowing normally. This is an excellent idea and should be adopted universally on reconditioned engines because it guarantees bearing lubrication when lubrication is needed most—during the first few revolutions of the crankshaft.

FIGURE 2
FORD V8 OIL RELIEF VALVE

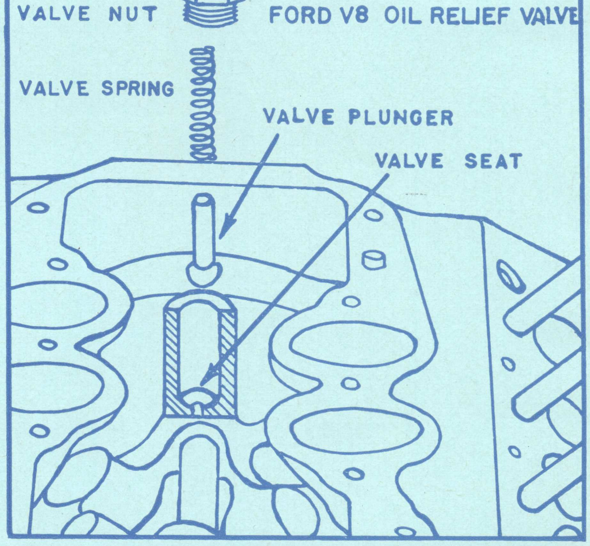

Fig. 2
Ford V8 Oil Relief Valve

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HOW TO USE TESTER

Before any connections are made remove the T handle plug, insert a funnel and pour into the tank at least two quarts of clean SAE 10 motor oil. Then screw the plug tightly against the copper gasket.

Before connecting an air chuck to the Schraeder clamp, close the three stop cocks and unscrew the top of the pressure regulator until it almost comes off. Use a long enough air line so that the tester can be set on the floor alongside of the engine being tested. A very small volume and only about 60 lbs. of air pressure are required, so that even the smallest model air compressor is adequate.

Next determine the most accessible place to connect into the oil pressure line of the engine. Typical places to connect the hose from the tester are the inlet oil line to the oil filter, the fitting where the oil pressure gauge on the dashboard connects into the main oil passage in the motor block, and one of the plugs in the block opposite the camshaft bearings.

If different size threads are encountered, use one or two of the fittings supplied with the tester to make the connection. When testing a motor that is equipped with an oil filter, it is advisable to connect the tester to the oil line supplying oil to the filter because this is not only most convenient, but it eliminates the necessity for plugging the return line of the filter.

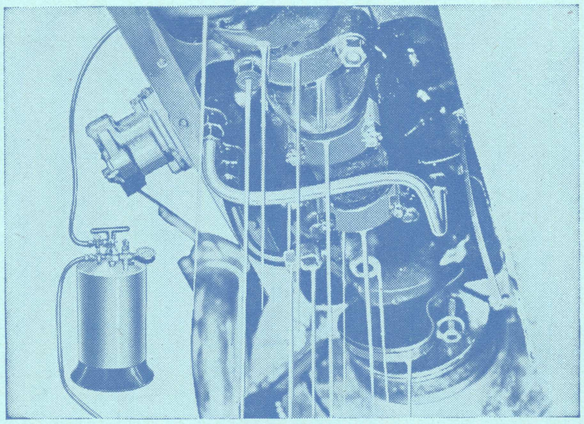

Fig. 3

If the oil pump is of the type which allows free passage of oil when not running, or in case the gears and plate of a gear type pump are worn enough to by-pass excessive oil, it is best to place a solid gasket at the point where the pump fastens to the engine block. When testing an engine such as the Ford V8 which has a slotted pressure regulating valve, a small amount of oil continually by-passes to the timing gears.

When it is desired to check the main bearings of an engine which has oil pressure only to the main bearings and lubricates the rods by the splash system, such as in Chevrolet, the oil pressure line going to the oil dipper troughs must be stopped off. Obviously the rod bearings in this type of engine cannot be tested.

Now with the air line tightly connected to the inlet side of the tester and the outlet tightly connected to the engine oil line and the lubricating system blocked off so that oil can only leak out of the bearing or by-pass the regulator, you are ready to start the bearing test.

Open the stop cock closest to the air chuck and gradually screw down (clockwise) the pressure regulating valve on the tester until the pressure gauge shows the specified normal pressure for the engine. Then open the stop cock at the oil outlet and quickly take a position from which all the bearings can be observed.

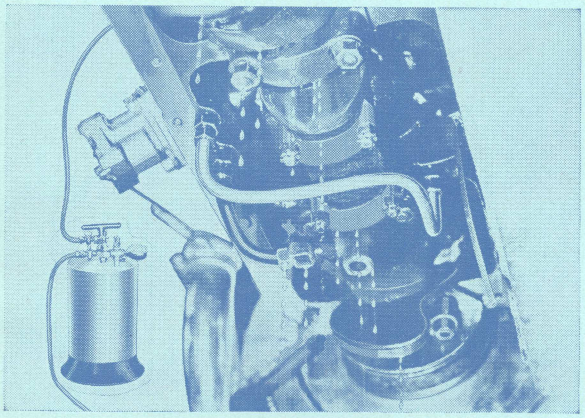

Fig. 4

The condition of the bearings is determined by the amount of oil escaping from the ends of each one. If no oil at all passes a bearing, either it is too tight or there is an obstruction in the line. A bearing which allows oil to bleed out so fast that it is difficult to notice any time interval between drops is definitely worn or of the wrong size and should be replaced.

A steady run of oil from the rod and main bearings, as shown in Fig. 3, proves that they are in bad condition and have been causing high oil consumption. Oil running down the sides of the crankcase or the webs indicates that the camshaft bearings need replacement.

A good bearing will permit the flow of a few drops of cold oil per minute, denoting the correct oil clearance. A typical example of normal flow is shown in Fig. 4. Since viscosity of motor oil decreases rapidly as temperature rises, it must be remembered that the warmer the oil, the faster will be the flow through the bearings.

As soon as the bearing condition has been noted and the pressure gauge and regulator on the engine have been checked, close the oil outlet cock and the air inlet cock on the tester. Immediately remove the air chuck and then open the pressure release cock between the pressure gauge and the regulator, so that oil will not leak out and make a mess after the tester is disconnected from the engine.

McQUAY-NORRIS SHOP SERVICE

TIME TESTED McQUAY-NORRIS AUTO PARTS PROVEN IN SERVICE

ALTINIZED RINGS PREVENT SCUFFING AND SCORING

Bulletin No. 22

The most critical time in the life of a piston ring is the initial run-in. Success or failure is pretty much determined at this time. If the rings seal immediately and mate-in rapidly to fit the cylinder contour, the blowby and oil will be held and the car owner will be happy.

Factors such as **cylinder finish, ring finish, pressure, lubrication** and **surface treatment of the rings** have gone through a gradual evolution toward the goal of producing fast mating without danger of scuffing and scoring.

The criss-cross scratches of a 280-grit hone make the ideal **cylinder finish.** This cylinder wall texture, when thoroughly clean of all grit and metal cuttings, hastens the mating of rings in both reringed and rebored engines.

Modern piston rings of gray iron material are turned with a small radius tool that is fed across the ring face at a speed to produce serrations within the range of 90 to 150 per inch. This slight saw-tooth effect reduces the area of the ring face that must wear in during the mating process. In this respect, **ring finish** is very important.

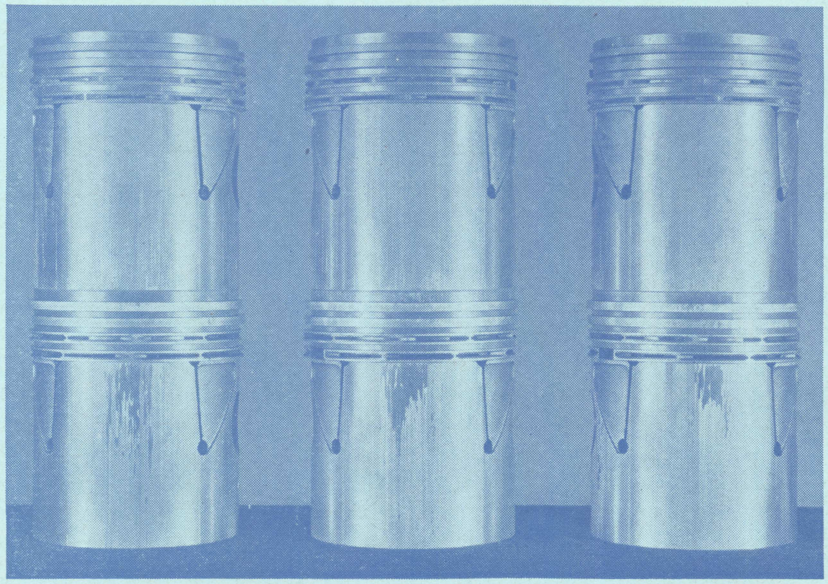

Fig. 1

Various tried and proven design features such as narrow ring width, face relief, grooving and torsional twist were developed to produce high enough **unit pressure** between the ring faces and the cylinder wall to resist the extreme gas and oil pressures found in high compression engines. Furthermore, to obtain high loading, almost the ultimate strength of the ring material is utilized by making rings with the maximum thickness and free gap that will still permit installation over the piston lands.

All of these efforts to get peak performance as soon as a reconditioned engine is started up are dependent upon **lubrication** for their effectiveness. In fact, metal to metal contact under the high unit pressures commonly used in piston rings today will result in severe cylinder scoring during the first few revolutions of the crankshaft if the ring surfaces are not protected by some form of lubrication. At best it takes a few seconds for the oil pump of a reassembled engine to build up pressure and force oil through the small clearances. During this time, some other form of lubrication is extremely valuable protection against scuffing and scoring and adds materially to the useful life of the rings.

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All McQuay-Norris rings are **surface treated** to have a .0003" coating of electrolytically deposited tin which literally functions as a metallic lubricant. It is almost impossible to scuff or score such rings so long as they are installed to operate as intended.

In contrast to the non-metallic ring coatings which must break down and abrade the ring face into the cylinder wall, the McQuay-Norris coating of tin, known as "Altinizing", is soft and therefore undergoes plastic flow to minimize surface irregularities. This congenial action insures an immediate seal against passage of blowby and oil.

In addition to the beneficial effect of the Altinized finish as a metallic lubricant and a fast sealer, there are additional benefits derived from the corrosion resistant and low friction properties of tin. Even though tin is comparatively soft, it does by its wetting or plastic action stay in the pores of the cast iron rings and cylinders for practically their entire life.

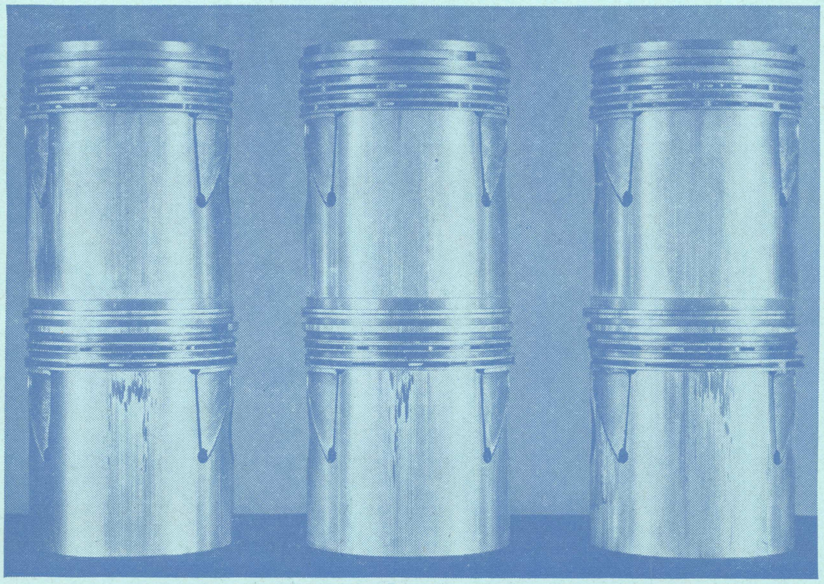

Fig. 2

Many tests have been run to conclusively prove the benefits of Altinizing. In these tests, using six-cylinder engines, three pistons in each engine were fitted with Altinized rings and three with untreated rings. The engines were then run in dynamometers under such conditions as normally would produce scuffing and scoring. In all of these tests only the pistons equipped with Altinized rings remained free of any trace of scuffing and scoring.

Typical of the results obtained are the pistons and rings shown in Fig. 1 and Fig. 2. In Fig. 1, the top row shows pistons Nos. 6, 4 and 2 equipped with Altinized rings and the bottom row shows pistons Nos. 5, 3 and 1 equipped with uncoated rings. In Fig. 2, the top row shows pistons Nos. 5, 3 and 1 equipped with Altinized rings and the bottom row shows pistons Nos. 6, 4 and 2 equipped with uncoated rings.

The evidence presented by the above photographs is conclusive. They give graphic proof that piston rings surfaced with electrolytically deposited tin (Altinizing)

—seal immediately

—mate rapidly

—do not score, scuff or erode

—resist acid corrosion

—are friction-free and hence more active in the groove.

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McQUAY-NORRIS SHOP SERVICE

TO RUN LONGER, CARS MUST RUN TRUE – ALIGN FOR LIFE

Bulletin No. 23

Car owners today will pay to keep their cars safe and in good running condition. While it is true that new cars are becoming more available every day, conditions of the early postwar period had the effect of making the car owner look about for ways to conserve his most convenient means of transportation.

The repairman can capitalize on this change in the state of mind of the car owner. The shop can be kept plenty busy by a little sales effort to acquaint customers with the repairman's ability to align and balance wheels, renew front end assemblies and correctly recondition the engine.

So far as the chassis is concerned, it will wear out less rapidly and require less power for maximum performance if in addition to being properly lubricated it is running free due to proper alignment. To begin with, observe whether or not the car stands level on the floor. Even the slightest hang should be corrected by spring adjustment or replacement of front and rear suspension parts before an attempt is made to check alignment.

To prevent rapid tire wear and the formation of flat spots due to wheel shimmy, start by replacing worn king bolts and bushings. A repair kit supplies all the needed grease retainers, lock pins, spacers, cotter pins, etc., besides the new bolts and bushings.

Don't be satisfied with inferior bolts, which will jeopardize the lives of passengers who will ride in the car thereafter. The best quality parts will cost hardly a dollar more per set than the cheapest. For that slight difference, the repairman and car owner can purchase the best material for the purpose, with proper heat treatment to give a tough shock-resisting core, a hard wear-resisting surface finish, and accuracy in dimensions which assures an easier installation. All of these add up to a much better and longer lasting job, with the least chance for breakage, causing a serious accident.

Check the king pin inclination to be sure that a bent frame, axle, or control arm has not changed the tilt of the king bolts toward each other at the top. The necessary corrections should be made by straightening or replacing damaged members so that the specified inclinations will be restored. This is the starting point of all correct wheel alignment.

While the front wheels are off, they should be balanced statically as well as dynamically, because both affect the car wear and steering. First check to see that when the tires were mounted, the valve stems of the inner tubes were lined up with the "light weight" mark on the side wall of each casing. Be sure to inflate each tire to the air pressure specified for the position it will occupy on the car. Also straighten any dents in the rim of the wheels so that there will be no trouble in fastening the balancing weights at the points on the rims where they will do the most good.

The balancing must be done carefully on accurate equipment, because a slight amount of weight out of balance becomes a big centrifugal factor at fast road speed. Careful checks have shown that only one ounce more of weight in the tread on one side of a tire than on the other actually increases to 11 pounds when the car is driven 60 miles per hour. This example gives the reason for vulcanizing a small casing break instead of using a boot. The weight of a small boot may not be impressive but in actual use its effective weight will be 100 to 200 times as great.

According to the Rubber Manufacturers' Association, wheel balancing affects six points:

1. Assures smooth, quiet car operation without shimmy, "tramp", or objectionable vibration.
2. Reduces spotty tire wear.
3. Reduces wear and tear on the automobile.
4. Increases tire mileage.
5. Promotes stability of operation at high speeds.
6. Improves the safety, comfort and convenience of driving.

Smooth operation of balanced wheels is governed by accurate setting of camber, caster and toe-in. Camber, of course, is the setting of the front wheels closer together at the bottom than at the top. Caster is the backward cant or inclination of the top of the front axle (king pin) from the vertical. Toe-in is the adjustment of the front wheels so that they are closer together at the front than at the back.

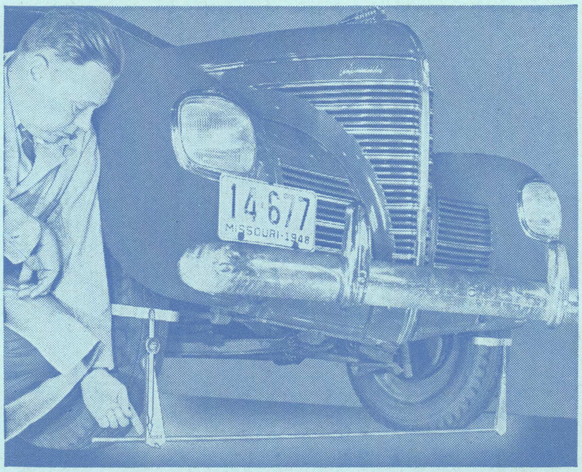

Fig. 1

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The camber angle should be adjusted either before or after putting the balanced wheels back on the car, depending on the type of equipment available for this operation. Also be certain that the caster angle is correct. In late model cars having individual wheel suspension, there are adjustments for both camber and caster. On older cars the axle must be bent to change the caster and king pin inclinations, while a change in the camber is accomplished by bending the steering knuckle support arm.

Practically everyone knows that the tie rod or rods of a car should be adjusted so that the front wheels toe-in slightly when the car is stationary, but the impression that the wheels run at an angle to the path of the car under normal driving is incorrect. If the wheels did not run practically parallel, there would be unnecessary tire wear. An excessive amount of toe-in will actually create this undesirable condition. Consequently the mechanic should have accurate data and should adjust the toe-in within the limits specified by the car manufacturer. (Fig. 1).

The specified toe-in is just enough to overcome both the tendency of the camber to make the wheels run-out and the forward movement of the car to force the wheels apart. Properly adjusted, the wheels will travel straight ahead with the least possible tire wear. On a turn, the length and angle of the steering arm permits a small toe-out which is necessary so both front wheels will revolve around the same point and not cause a side slip action on one tire.

If the various angles and inclinations of front end geometry are hard to remember, it may help to express the terms as simply as possible.

Top of king pins tilt in—King Pin Inclination.

Top of king pins tilt back—Caster.

Top of front wheels tilt out—Camber.

Front of front wheels turn in—Toe-in.

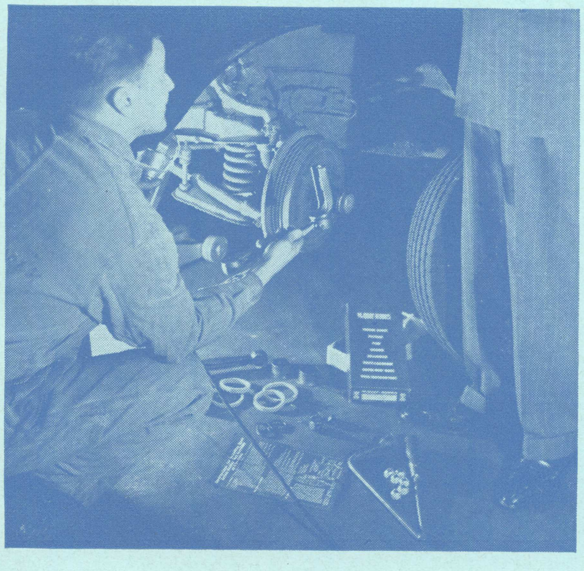

Fig. 2

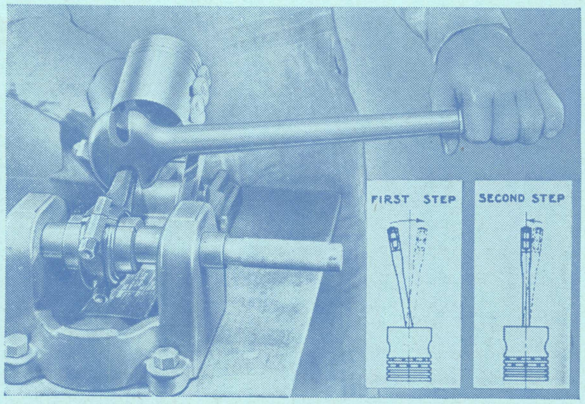

Fig. 3

For easier remembrance, associate **back** tilt of king pin, which is **caster,** with the **back** lash of an angler's **cast.** Starting from this point, the correct meaning of **caster** and **camber** can always be figured out.

With each kit of McQuay-Norris wheel suspension parts an installation blue-print is supplied, listing the correct camber, caster and toe-in specifications for the car models that the parts fit. (Fig. 2).

Every mechanic knows that an engine must be correctly timed and adjusted, otherwise it will not run smooth. If not accurately tuned up, modern engines, mounted on rubber, will literally shake themselves to pieces.

On the subject of alignment, we should mention the importance of installing new ignition points so they will have 100% contact besides the proper gap.

Connecting rods are the best example of the necessity for alignment. Every rod assembly should be carefully aligned before installation so that the new rings will line up squarely on the cylinder walls (Fig. 3). Besides affecting oil consumption and blowby, a bent or twisted rod causes excessive friction which may raise the cylinder temperature enough to develop into scuffing and scoring. However, the loss in horsepower caused by the drag of bent rods is reason enough in itself for making sure that alignment is correct.

Precision manufacture of engines and parts has progressed remarkably fast, so that present models are designed with extremely close fits. Therefore a mechanic making repairs must be very careful to maintain accurate alignment and adjustment of all parts so that the engine will run free. A repaired engine should never be too tight for the starter to turn over, providing the battery is fully charged. A long run-in should not be necessary to obtain smooth, free operation.

McQUAY-NORRIS SHOP SERVICE

SPLIT BUSHINGS ARE HERE TO STAY

Bulletin No. 24

There are three considerations in determining the best type of bushing to use in applications such as king bolt bushings, shackle bolt bushings, connecting rod bushings and rocker arm bushings:

1. PERFORMANCE 2. INSTALLATION 3. AVAILABILITY

1. PERFORMANCE: Split bushings definitely last longer. But why, when both the solid and split type can be made to the same bronze analysis of copper, zinc, lead and tin? The reason is that work hardening in the fabrication of the split bushing improves the metal.

The ancient Greeks and Romans made bronze alloys consisting of copper and tin plus accidental impurities. Their principal uses in those days were in the form of sharp-edged tools and weapons of war which were made by crude methods of hammering and heat treatment. Only because of the hammering and heat treatment were these early implements hard enough to hold a cutting edge. It is this hardening effect of hammering, now known as work hardening, which can be applied to a split bushing but not to a solid bushing.

The beneficial effects of the process used in the mill to produce the strips from which the bushings are made is best illustrated by an example. The best rolled bronze bearing alloy has the following composition and is known as "Easy Ream"—

Copper	92.25%	Nickel	1.75%
Zinc	2.4%	Tin	1.4%
Lead	1.75%	Iron	.45%

When the ingot has been melted down and deoxidized, it is cast into slabs 1¼" thick x 10½" wide x 60" long. After cooling, it is cold rolled and annealed repeatedly until the desired thickness and hardness of the bushing stock is reached. The resulting material shows structural refinements such as uniform fine grain structure and absence of porosity which greatly increase the physical properties. The tensile strength is 2½ times that of the "as cast" solid bushing material; the yield strength, which indicates ability to resist "pounding out", is increased 4 times, the density increased 6.6% and the hardness is 2½ times greater.

These comparisons do not mean that the cast bushing material is not serviceable, but certainly do prove that the work hardened material of the split bushing is a great deal better from a performance viewpoint. The proven performance superiority of split bushings has caused many of the car manufacturers to adopt this type and is now being reflected in the replacement parts field by a similar trend.

2. INSTALLATION: The actual pressing in of the split bushing presents no difficulties over that of the solid bushing. The length of the strip that is rolled round to form the split bushing is now so accurately controlled that a uniform tight fit can always be obtained providing the hole into which it is pressed is not oversize. Even if the hole is stretched or worn oversize, a satisfactory installation can be made by tinning the outside of the bushing with a soldering iron. Then when the bushing is pressed into place, any excess solder will be shaved off, but the bushing will be tight.

Many of the split bushings in the field at the present time have a straight split. Finishing of these bushings to fit the bolt, pin or shaft can be easily accomplished so long as either a spiral reamer or a pin hole hone is used. Neither tool will be affected by the straight split line of the bushing. A straight reamer should not be used in these straight split type bushings, due to the cutting edges being parallel to the split line, so that they might catch and chatter, or even break the reamer or turn the bushing.

In order to permit the use of a straight reamer, McQuay-Norris is gradually changing over to the new Easy Ream Envelope Seam bushing design having a wide "V" envelope (see Fig. 1). Not only are the material and seam a marked improvement, but the inside diameter is chamfered at the ends. Repairmen report that this chamfer permits the reamer to enter and take hold gradually so there is freedom from chatter in fitting. This bushing is well named "Easy Ream". Look for the identification "EZ" on the McQuay-Norris bushings now being supplied to distributors (shown in Fig. 2).

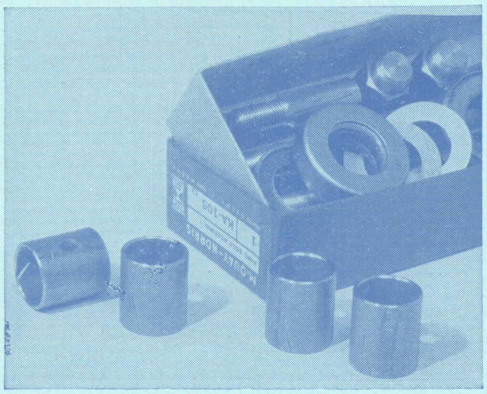

Fig. 1

So tight does the new envelope seam fit and so nice a reaming or honing job can be done that actually it is extremely difficult to find any trace of the split after the fitting operation.

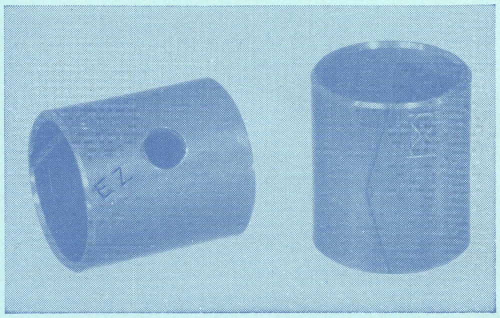

Fig. 2

To overcome any possible objection to removing the far superior although harder split bushing material in the fitting operation, this new type bushing is now made with an absolute minimum material allowance for reaming or honing. The .002 allowance is just enough to clean up any irregularities or distortion caused by the installation. Therefore, using a sharp reamer or a clean, true hone, the fitting work is readily accomplished without difficulty.

3. AVAILABILITY: In view of the fact that the split bushings are now available in greater quantities and McQuay-Norris is furnishing the new Easy Ream Envelope Seam design, repairmen should learn to use this type and take advantage of its outstanding characteristics. Split bushings will stand up under harder service so that much greater freedom from trouble is assured.

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WINTER COOLING SYSTEM RECONDITIONING

Bulletin No. 25

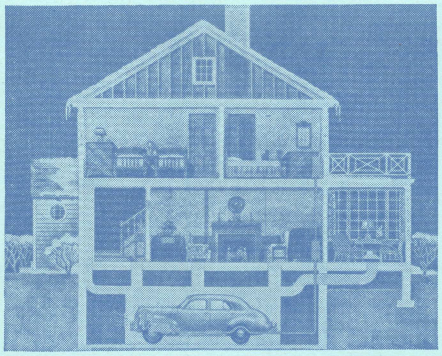

Fig. 1

At this time of year there is the usual flood of business on cooling system reconditioning for winter operation. Therefore it seems a good idea to review the subject, get up to date on any new developments, and make certain that some little—but important—points are not overlooked.

Unlike steam engines, where fuel is burned outside the cylinder, the internal combustion engine has the combustion take place within the cylinders, and the resulting heat produces a cooling problem. The combustion process, even in the smaller automobile engines, can produce as much heat as would be required to keep a six-room house warm in zero weather (Fig. 1).

Only about one-third of the heat of combustion is used to produce the gas pressure that drives the engine. The remaining two-thirds is waste heat, and most of it must be removed to prevent destruction of the engine. Again, only about one-half of the waste heat is carried off through the exhaust pipe. This leaves a large amount of excess heat in the engine which must be removed by some other means, namely the cooling system. The temperature of exhaust gas leaving the engine may be over 1000° F., while combustion temperatures inside the engine may rise as high as 4000° F. To prevent such high internal temperatures from damaging the engine, a cooling system is provided to draw off the excess waste heat as fast as it is produced, and keep the operating temperature within safe limits.

Automotive engines use the liquid cooling system. A liquid, ordinarily water, and known as the "coolant" is used as the medium to carry heat out of the engine and transfer it to the surrounding air.

In the conventional water-cooled engine, waste heat is removed by the coolant circulating through hollow passages surrounding the hottest parts of the engine, such as valve ports and cylinders. The coolant then moves on through similar passages in the head, picks up more heat as it circulates. Then it passes through an outlet hose connection and carries the heat into a radiator.

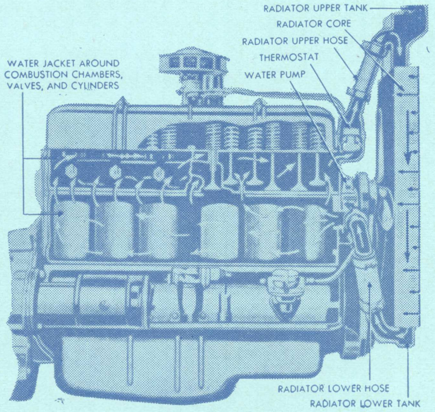

Fig. 2

As coolant flows down through the radiator, the heat is transferred to air moved by the fan and the forward motion of the car. From the bottom of the radiator, the coolant is drawn into the lower hose connection of the pump, which forces it back into the engine to make another cycle (Fig. 2).

If the size of this cooling job was generally realized, more repairmen would avoid troubles on overhaul jobs by making the necessary repairs to obtain peak efficiency of the cooling system. The cooling system of a large truck, for example, removes enough heat at cruising speed to keep a 35-room house warm in freezing weather . To handle this heat load it may be necessary for the cooling system to circulate 4,000 to 10,000 gallons of coolant per hour (Fig. 3).

Full-length engine water jackets, large efficient radiator cores and rapid coolant circulation make it possible to keep the engine cool when operating under heavy load in hot weather. Under lighter engine load in cool weather, the same amount of cooling would remove too much heat from the engine. Overcooling results in waste of fuel, loss of power and rapid wear of moving parts. Therefore, the amount of heat removed from the engine must be controlled for different operating conditions and air temperatures. This is done by the thermostat, which regulates engine temperatures by automatically controlling the amount of coolant flowing through the radiator core.

One type of thermostat is a closed bellows, which contains a special liquid designed to boil at a certain temperature. When that temperature is reached the boiling liquid creates gas pressure which expands the bellows and opens the thermostat valve. When the gas cools and condenses, the pressure is reduced, allowing the bellows to contract and close the valve. In another type of thermostat the valve is operated by a bimetallic coil which depends upon the difference in thermal expansion of the two metals. The coil expands and opens the valve when heated above a certain temperature. As the coil cools it contracts and closes the valve.

In reconditioning the cooling system for winter operation, the thermostat is an important factor, and if faulty it should be replaced.

Some engines, particularly L-head types, have a water distribution tube in the water jacket extending from the water pump to the rear end of the engine. This long, flat, thin-walled tube has an opening at one end facing the pump outlet. It also has a number of outlet openings along one side which face the water passages around the exhaust valves. The water distribution tube receives coolant from the pump and delivers it through the spaced outlet openings directly to the hottest parts of the engine, such as the exhaust valve seats.

The water distribution tube is an important point in winter overhaul. These tubes become corroded and are sometimes practically eaten away. Therefore the tube must be checked, and to do this it is necessary to remove the water pump and examine the tube. If replacement is warranted, the radiator must be removed in order to pull out the tube. This gives an opportunity to clean the accumulation of muck in the block and also treat the block to remove rust and scale. This subject is covered in more detail in Shop Service Bulletin No. 3.

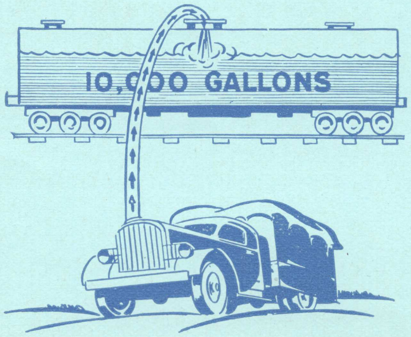

Fig. 3

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In normal weather a proper designed cooling system will operate efficiently so long as it is clean. Winter weather, on the other hand, presents a major problem because a coolant must be a liquid to move heat out of an engine. When water freezes at 32° F. it forms solid ice and expands approximately 9% in volume. This expansion takes place with a force that can exert tons of pressure. If water is allowed to freeze inside the cooling system, this extreme pressure will cause cracking of any part in which it is trapped, as every garageman well knows.

Therefore anti-freeze must be added in cold weather. Ethylene glycol, methanol (synthetic methyl alcohol) and ethyl alcohol are the most commonly used anti-freeze materials. Isopropanol (isopropyl alcohol) is also used, though alone it is a less effective anti-freeze than the others and is usually sold as a blend with methanol. These materials are capable of lowering the freezing point of water to the lowest temperatures likely to be encountered in vehicular service.

Standard anti-freeze products using any of these materials also contain ingredients called corrosion inhibitors to increase their chemical stability and to prevent corrosion. All of these anti-freeze materials are organic and non-electrolytic.

Oils, sugars and inorganic salt solutions are unsatisfactory for use as anti-freeze. The use of kerosene and other oils and the use of sugar solutions is not likely to be encountered in ordinary garage practice. But calcium chloride or similar salts are offered to the public every fall under a variety of trade names and with considerable promotion behind them. It is necessary, therefore, to issue a warning about such anti-freeze solutions. They are extremely corrosive to cooling system metals. Slight leaks in upper hose connections can cause short circuits in the ignition system. Another objection is the possibility of crystal formation in the radiator, which would restrict circulation.

If the cooling of the engine is to be maintained at new vehicle efficiency, rust deposits must be prevented from forming. Corrosion of iron and other cooling system metals must be held at a minimum. Rust inhibitors for water are inexpensive and simple to use and they make cleaning and flushing unnecessary. Standard anti-freeze products, of course, contain corrosion inhibitors and it is therefore not necessary to add extra inhibitors to them.

There are two types of inhibitors in general use—soluble oils and salts. Use either type only in the proportion recommended by the manufacturer. Corrosion inhibitors do not remove rust already formed in the system. Any such rust should be cleaned out before the inhibitor is added to the new coolant. To use the inhibitor, start with the system clean and simply fill it nearly full with fresh water and add the recommended dosage, then operate the engine until it reaches driving temperature, to open the thermostat and establish circulation through radiator and engine block for complete mixing.

In the spring when the anti-freeze is drained, flush the system thoroughly and clean if necessary. Then install a fresh filling of summer rust inhibitor and water. The inhibitor treatment prevents corrosion and rust by chemical action and the deposit of a thin protective film on the inside walls of the cooling system. In a system that was cleaned originally, the appearance of rust in the radiator or in solution is an indication that the inhibitor is weakened from adding water or is exhausted from use. In either case the solution should be drained, the system flushed, and a fresh filling installed.

The cooling system and the lubricating system are dependent on each other for proper operation. Oil circulation assists in keeping the engine at proper operating temperature by transferring part of the waste heat from pistons to cylinder walls and by removing heat from bearings. On the other hand, satisfactory lubrication depends on proper operation of the cooling system. If the coolant fails to remove its share of waste heat, the resulting high metal temperatures may reduce or destroy the lubricating value of the oil. Excessive heat will also cause chemical changes in the oil, producing sludge, varnish and other harmful deposits. Overcooling also interferes with proper lubrication.

Overcooling wastes fuel and overheating causes vapor lock. Conversely, an improper mixture of fuel and air raises the coolant temperature by increasing the amount of waste heat in the engine which must be carried away by the cooling system.

Improper cooling of the combustion chamber walls causes such high temperature that the spark plugs rapidly deteriorate. In turn, improper ignition, especially late timing, increases the amount of heat thrown into the cooling system and is a common cause of overheating.

The operator of the car, of course, plays an important part in preventive maintenance of a cooling system, and only through him can the mechanic hope to know exactly what trouble the cooling system is giving. **Practically all** cooling system troubles can be detected by the driver in their early stages before they seriously affect vehicle operation and while they are still easy to correct. The two most important indications of cooling system condition are **coolant operating temperature** and **coolant level.** Leaking or defective parts are nearly always indicated by the engine temperature gauge or level of the coolant in the radiator, or both.

Leakage is more common in the cooling system than in any other liquid-carrying unit, due to the stresses and strains set up in joints and connections by wide changes in coolant and metal temperatures, especially during cold-weather operation. Engine vibration, road shock, and deterioration of gaskets, and wear, breakage, or corrosion of metal parts may create leakage, and these conditions are often more severe in heavy duty operation. The radiator pressure cap, which is used on many vehicles, creates additional pressure in the system, thereby increasing the leakage tendency at hose connections and other water joints. Radiator leakage may be caused by accidental damage to the core from flying stones or minor collisions with other vehicles or objects.

The engine water jacket has many gasketed water joints and a number of metal water joints in both block and head, where neglect may result in leakage. Gaskets deteriorate from the effect of heat, water pressure and vibration. Metal joints, such as core hole plugs, drain plugs, shut-off valves, temperature gauge fittings and connections at water bypass tubes, are all subject to leakage. Any leakage at water jacket joints or casting cracks is aggravated by pump pressures which may run as high as 35 pounds per square inch. Combustion chamber joints are subjected to pressures as high as 600 pounds per square inch or more. Leakage of coolant into the engine can cause serious damage, especially in cold weather. Either water or anti-freeze solution, when mixed in large quantities with engine oil, will form sludge which may cause lubrication difficulties. Even though the joint is tight enough to prevent liquid leakage, the slightest looseness will allow combustion gases to be blown into the cooling system. This can force coolant out of the overflow pipe. Burned gases dissolve in the coolant to form acids which cause rapid rust formation and attack metal parts.

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Cylinder head bolts cannot be evenly tightened with an ordinary wrench. The use of a torque wrench is necessary to obtain proper uniform pressure on all bolts and to avoid warpage of the head or distortion of the block at valve seats and cylinder bores from overtightening. The extreme importance of maintaining cylinder head joint tightness demands careful attention to all instructions on installation of new gaskets, proper order for tightening bolts, correct torque to apply, and rechecking torque following a new gasket installation.

The water pump is the only power driven unit in the cooling system and is therefore subject to the wear to be expected on moving parts. Pumping failures are most often caused by broken or loose drive belts, but edge wear of impeller blades and wear of the pump housing also reduce pumping capacity. Sand, rust and other abrasive foreign matter in the coolant have a tendency to wear away impeller blades. Corrosion of the impeller and housing may result from failure to use a corrosion inhibitor or failure to discard rusty anti-freeze solution. Operation of the engine with the coolant frozen may shear off the impeller pin and leave the impeller loose on the shaft, or cause slippage of the pump belt drive that would burn the belt at the driving pulley.

Leakage is a more common trouble than pumping failure. The pump housing joint is under strain from the pump drive and may work loose and leak if the mounting bolts are not kept tight. The water pump shaft and seal assembly forms the only moving water joint in the cooling system. In the adjustable gland-type pump, normal wear of the packing will allow leakage unless the gland is tightened periodically and the packing replaced when worn. The shaft and bearing will be damaged if the packing gland is too tight.

In the newer packless-type pumps, the self-adjusting seals are subject to wear, deterioration and leakage. Thrust seal washers and seats are prematurely worn by abrasive action of sand, dirt, and rust in the coolant and damaged by operation with the engine overheated. Bearing and shaft damage, which leads to leakage and pump failure, can result from neglect of lubrication in pumps that require it. But over-lubrication, especially with a high pressure gun, forces grease into the cooling system, which contributes to clogging and overheating.

Forced coolant circulation is so necessary in the modern cooling system that any reduction in pumping capacity causes a loss of cooling effectiveness. Even a slight leak at the pump seal or in the connections between pump and radiator will allow air to be sucked into the cooling system at high engine speeds. This condition can force enough liquid out of the overflow pipe to cause serious coolant shortage. Furthermore, the introduction of air into the system speeds up rusting as much as 30 times and also greatly increases corrosion of all cooling system metals. Clogging and corrosion go hand in hand with neglected water pump leakage and aeration.

In view of all these possibilities of trouble, water pumps require careful maintenance in the form of frequent inspection, periodic tightening and proper lubrication.

A chemical combination of iron, water and air produces rust. The water jacket of the automotive engine has a large mass of iron exposed to the cooling water, and no cooling system is free of air. Over 90% of the solid matter that clogs radiators is rust.

Electrolytic corrosion can also result in the cooling system from a combination of different metals in contact with each other, such as the soldered seams in copper or brass radiators, brazed joints in steel tubes, copper gaskets in contact with iron, and imperfect plating on thin steel parts. Although the current is weak, exactly the same action takes place as the electrolysis phenomenon in a storage battery.

From all the above it will be seen that cooling system reconditioning is by no means a simple task. But a little trouble taken with it now will save a lot of trouble when the zero weather comes.

McQUAY-NORRIS SHOP SERVICE

HUDSON SIX MAIN BEARINGS

Bulletin No. 26

The subject of main bearings for the Hudson six-cylinder engine has probably been discussed in every garage in the country without many definite conclusions being reached. No doubt the unanswered questions have been: When are shims needed and why? Do the present day precision bearings for Hudson Six require shims?

Some few 1941-42 model engines and all prior models have the main bearing caps bored .021 below the center line so that a shim pack approximately .020 thick must be installed between the cap and saddle to make a round hole to receive the bearing insert. If the bearing halves and the hole are not accurate, the shim thickness must be adjusted to obtain a tight fit. The shim pack not only goes between the cap and saddle but must be between the bearing halves when the type of bearing being installed has one half longer or higher than the other. During installation the repairman should consciously push the shims in tight against the bolts to make certain they are between the ends of the insert bearings.

Modern precision bearings, as the name implies, are all alike in essential dimensions as well as fit. Precision bearing inserts as made by McQuay-Norris and since 1941 by Hudson are very accurately machined in length or circumference and in wall thickness. When installed in a round and exact diameter hole formed by the bearing cap and saddle they are tight on the outside and have .001 to .002 oil clearance on an accurate crankshaft journal.

The answer to the second question is that no shims should be needed if no shims are found when the main bearing caps are pulled down. Since 1941 the Hudson factory has precision line bored the saddles and caps in their engine blocks and has installed precision bearings in most of their engines so that alignment, tightness of the bearings in the block, and proper clearance of the crankshaft journal in the bearings has been obtained without shims.

With the precision bearing requiring no shims, the tightness of the bearing insert on the outside is obtained by an extra .0015 allowance in the length of each bearing half. This is known as "crush" allowance. When installing new bearing inserts in any engine, there should still be room to slip a .002 or .003 feeler strip between the cap and saddle after the nuts have been just drawn down snug. It is the safest policy, especially on Hudson Six engines, to check this crush before applying the tightening pressure. With this assurance you can then tighten the nuts to the specified torque and know that the ends of the new bearing will be slightly crushed together, and this crush will hold both halves tight so there will be good heat transfer as well as a good fit on the crankshaft. Precision insert bearings are also made .000¾ thinner right at the ends, so any slight bulging of the babbitt lining inward due to the crush will not destroy the oil clearance, which would possibly cause binding of the crankshaft.

Particularly in the older Hudson engines, containing the shim pack, the above procedure should be carefully followed, because the shim thickness may have been changed by some other mechanic. So put in enough shims to obtain the .002 or .003 clearance between the bearing cap and the shim pack when the nuts have been run down just enough to bring the ends of the bearing halves together firmly. Then tighten to the specified tension. When an accurate inside and outside micrometer are available a careful measurement of the bearing hole while the cap and saddle are bolted tightly together will quickly ascertain how many shims, if any, are required to make the hole round. Also, the best bearing job in any engine is obtained by align boring the mains.

It is also advisable to check the oil clearance with a .002 feeler strip on these older jobs, because the older McQuay-Norris insert main bearings, Nos. 2447, 2448 and 2449, were made short in height to accommodate the .020 shim and have a tendency to fit a little tight on an unworn crankshaft journal. Use enough shims to avoid binding and get proper oil clearance. Also the upper half of the old style bearing is held in place by a flat head screw. Be sure to install this screw as it not only locates the bearing but keeps it from turning in the saddle.

Now that Hudson has eliminated the .020 shim and has adopted the precision insert, McQuay-Norris has lengthened the No. 2447, 2448 and 2449 bearings and has made the wall thickness .001 less, to exactly duplicate the latest Hudson bearing Nos. 162538, 162539 and 162540 for the 1939-47 six-cylinder engine. Likewise, McQuay-Norris has announced new bearing Nos. 3514, 3515, 3516 and 3517 to serve as precision replacements for the 1948 Hudson precision bearings, Nos. 300132, 300133, 300134 and 300135. These bearings contain Hudson's change to a lug end lock instead of the countersunk flat head locating screw that is used in the 1947 and earlier models. This change also makes the Hudson bearings more conventional so that repairmen will have less difficulty in making replacements.

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HOW TO INSTALL INTERNATIONAL DRY SLEEVE ASSEMBLIES

Bulletin No. 27

If there ever was a controversial subject the above is one. Apparently the factory's departure a few years ago from the conventional wet cylinder sleeve assemblies in their BLD 269 and RED 450 engines in favor of a flanged dry sleeve assembly confronted repairmen with a new problem which is only now being solved. Many ideas and experiments have been tried and some have merit. Let us review the entire subject.

The sizes of original equipment blocks and sleeves are coded as follows:

BLD 269 and 250

Inside Diameter of Block	Outside Diameter of Dry Sleeve
A — 3.8105 — 3.8108	A — 3.8104 — 3.8108
B — 3.8108 — 3.8111	B — 3.8107 — 3.8110
C — 3.8111 — 3.8114	C — 3.8110 — 3.8113
D — 3.8114 — 3.8117	D — 3.8113 — 3.8116

On the **RED 361, 401 and 450** the sleeve size is 4.5015 to 4.5025 and the tolerance on the block diameter is 4.4990 — 4.5008.

The new engines have the block and sleeve letters matched. For example, a "B" lettered sleeve will be in a block hole lettered "B". (Do not confuse this lettering code with the same A, B, C or D letters stamped on the piston and sleeve to designate the inside diameter of the finished sleeve in a McQuay-Norris sleeve assembly. See Shop Service Bulletin No. 11.)

It was the International factory's intention that in replacing sleeves in the field the next higher lettered sleeve would be used; for example, a "B" lettered sleeve would be installed in an "A" lettered block hole to get the same fit as the original installation. When the sleeve assemblies were replaced a second time, a "C" lettered sleeve would be installed in an "A" lettered block hole. This system had good intentions but broke down because garages usually did not have on hand the necessary number of dry sleeve assemblies carrying each code letter to handle each job according to the system. Finally the factory issued a bulletin advising garagemen to disregard the code and use any sleeve in any hole.

This did not alter the necessity for getting just the right sleeve fit. It must not be too tight or the finished inside diameter of the sleeve will be squeezed smaller, causing insufficient piston clearance, resulting in scoring. It must not be too loose, or poor heat transfer, distortion and hot spots will cause carbon formation, ring sticking, and piston burning, resulting in high blowby and oil consumption.

Plating of a soft metal on the outside of the new sleeve was a logical approach to the solution of this problem, and the first to be tried. Tin plating and copper plating have been used. Both work satisfactorily and many shops that have had local plating companies make the necessary holding fixtures are still having all of this type sleeve plated with approximately .003 tin or copper. During installation excess plating shaves off as the sleeve is forced into the block and the fit ends up just about right. However, the disadvantages of this method are the extra expense and additional time required.

Experiments were run on the idea of honing out the distorted block to .010 oversize and then installing special .010 oversize sleeves with about .000¾ interference fit. In most cases this also works satisfactorily, but of course honing out .010 is no easy task. On the other hand, it is actually a fact that the holes do not clean up at .010 oversize in all engines, especially those in which the sleeves have been replaced quite a few times because excessive distortion caused them to be stubborn oil pumpers or chronic scorers.

In the final analysis, the most practical method to cure these troublesome jobs is to bore out the block to .030 and then by honing and checking the new sleeve, arrive at slightly tighter than size for size fit. The interference, if any, should not exceed .000½. Use glycerine, Stoddard solvent, kerosene or similar light sealing lubricant between the outside of the sleeve and the cylinder bore before pressing.

When the correct cylinder size has been reached, the sleeve should go down to within 4″ of its final position when pressed with the palm of one's hand. The rest of the way a wood block and heavy hammer should be used to drive the sleeve home. Artificial cooling of the sleeve with dry ice is not necessary because the fit of this type sleeve must never be anywhere near so tight as the .003 interference used when installing regular dry cylinder liners which are not finished on the inside until after installation.

By boring and using .030 oversize sleeves the common trouble caused by loose sleeve fit and distorted blocks can be avoided. Since this type of trouble is accentuated by overloading and almost every heavy truck is overloaded these days it is appropriate to point out other precautions. Be sure to use a torque wrench on the head and manifold bolts. Make certain the manifold is not warped to allow air leakage, which raises the operating temperatures due to leaning the fuel mixture. See that the carburetor jets are slightly on the rich side to avoid a lean mixture. It has been proven that lower cost per mile of operation as well as better performance will be experienced from a fuel-air ratio favoring the rich side. A good grade of fuel pays off in longer maintenance-free operation.

In persistent cases of ring and valve sticking an oil type additive to the gasoline will lower the combustion chamber temperature as well as provide upper cylinder lubrication and thereby help to overcome the trouble. An occasional case is corrected by changing from a naphthenic base motor oil to a paraffinic base oil or vice versa.

The .030 oversize dry sleeve assemblies for the various model International engines mentioned in this bulletin are available at all McQuay-Norris Factory Branches. These are of the 500 Brinell hardened type to give maximum mileage. Each sleeve assembly contains the hard sleeve, piston, pins, locks, the most efficient type of piston rings, and a complete blueprint instruction sheet.

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McQUAY-NORRIS SHOP SERVICE

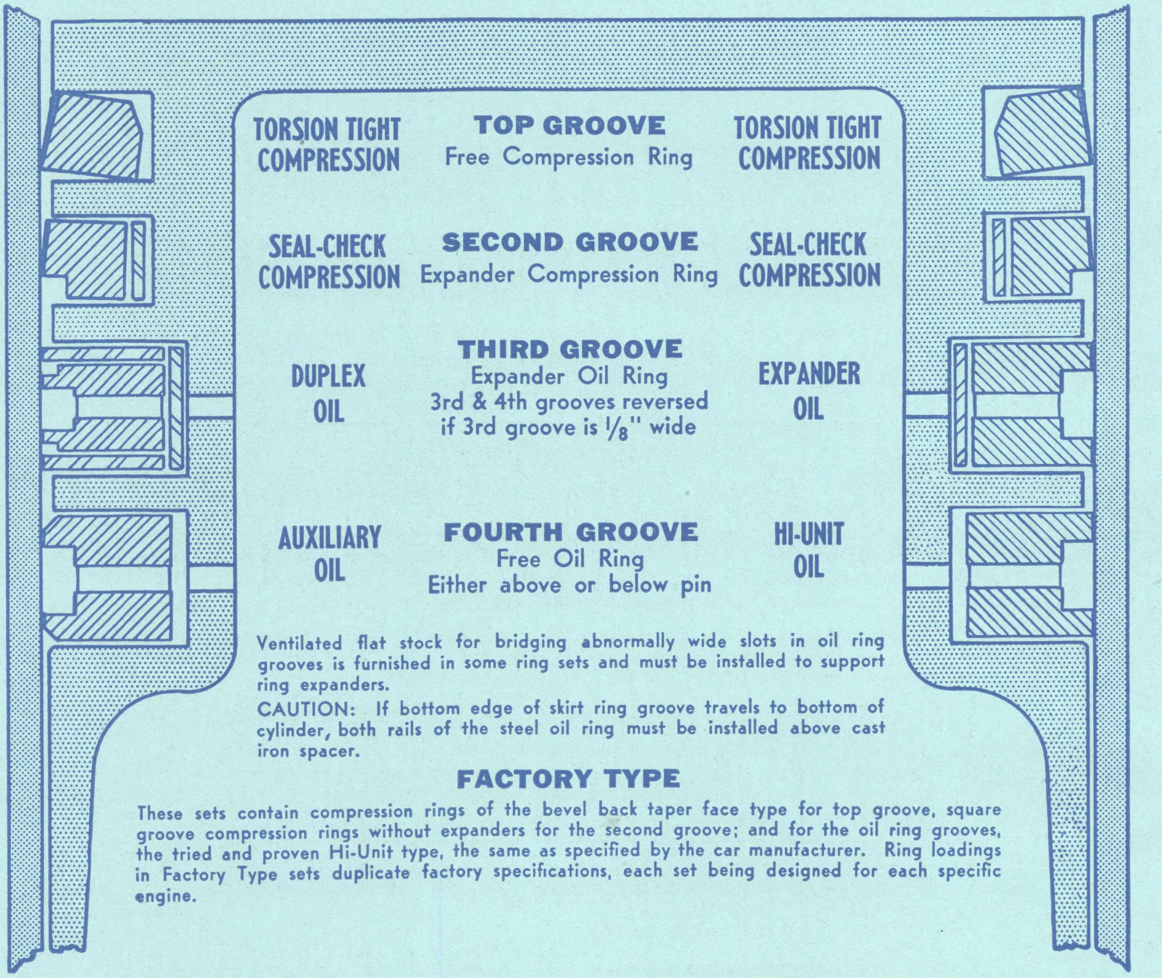
TIME TESTED McQUAY-NORRIS AUTO PARTS PROVEN IN SERVICE

CORRECT ENGINEERING AND INSTALLATION OF PISTON RINGS

Bulletin No. 28

By diligent effort through the years, McQuay-Norris engineers have developed the present types and combinations of compression and oil rings for different motor conditions so that repairmen can have full confidence in the performance ability of Leak-Proof, Rebore-Rebuild and Factory Type piston ring sets. Rings are properly loaded for each application.

LEAK-PROOF **RING TYPES** **REBORE-REBUILD**



Ventilated flat stock for bridging abnormally wide slots in oil ring grooves is furnished in some ring sets and must be installed to support ring expanders.

CAUTION: If bottom edge of skirt ring groove travels to bottom of cylinder, both rails of the steel oil ring must be installed above cast iron spacer.

FACTORY TYPE

These sets contain compression rings of the bevel back taper face type for top groove, square groove compression rings without expanders for the second groove; and for the oil ring grooves, the tried and proven Hi-Unit type, the same as specified by the car manufacturer. Ring loadings in Factory Type sets duplicate factory specifications, each set being designed for each specific engine.

INSTALL RINGS CORRECTLY

When ordering new piston rings be sure to tell distributor the correct make, model and year of car and also the type of piston. Have distributor furnish the best ring set number for condition of engine being overhauled and the extent of work being performed.

The correct ring size is determined by the smallest cylinder measurement, which will be found by miking below the ring travel. Consult following table to see if ring gaps must be filed to fit odd cylinder sizes.

Smallest Cylinder Measurement	Correct Ring Size	End Clearance Fitting
std. to .010	standard	None required
.011 to .019	.020 oversize	File fit to cylinder size (see clearance table on back side)
.020 to .024	.020 oversize	None required
.025 to .029	.030 oversize	File fit to cylinder size (see clearance table on back side)
.030 to .034	.030 oversize	None required
.035 to .039	.040 oversize	File fit to cylinder size (see clearance table on back side)
.040 to .049	.040 oversize	None required
.050 to .059	.060 oversize	File fit to cylinder size (see clearance table on back side)
.060 to .069	.060 oversize	None required
.070 to .079	.080 oversize	File fit to cylinder size (see clearance table on back side)
.080 to .089	.080 oversize	None required
.090 to .099	.100 oversize	File fit to cylinder size (see clearance table on back side)
.100 to .109	.100 oversize	None required

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Below is shown the minimum end clearance for each one-inch range of cylinder sizes that will prevent butting and seizure from thermal expansion in operation, also the maximum desirable end clearance.

PISTON RING END CLEARANCE

Diameter of Cylinder	Minimum End Clearance	Maximum End Clearance
0 — $1\frac{31}{32}$	.005	.013
2 — $2\frac{31}{32}$	.007	.017
3 — $3\frac{31}{32}$	.010	.020
4 — $4\frac{31}{32}$	.013	.025
5 — $6\frac{31}{32}$	.017	.032
7 — $8\frac{31}{32}$	.023	.032
9 — 12	.003 per diametral inch plus .015	

Also check the rings for correct width and side clearance. Side clearance as shown below should be allowed.

RING SIDE CLEARANCE IN PISTON GROOVES

Aluminum Pistons	Cast Iron Pistons
.0015 to .002 top groove	.002 to .0025 top groove
.001 to .0015 lower grooves	.0015 to .002 lower groove

Ring grooves worn to excessive side clearance should be reconditioned and groove fillers installed. Check pistons for worn grooves and if more than .005 side clearance exists, recut grooves with a Groove-Rite Tool to the next ring width and use a .030 wide groove filler. See Bulletin No. 10.

Check back clearance for expander type rings. Use a McQuay-Norris back clearance gauge. See Bulletin No. 7. Back clearance should be .030 to .050 where an expander is used. McQuay-Norris ring sets will have correct back clearance providing the piston grooves actually have the correct specified depth. It takes only a minute to check each job and finding the exceptional case where the grooves are off due to abnormal variation in manufacture or changes in the field will avoid trouble. If it is determined that the grooves are too deep for the expanders to exert their specified loading, shim stock of .015 thickness can be used to reduce the groove depth. Usually one thickness is sufficient to make the groove standard, although in some cases two thicknesses are required.

If, on the other hand, the grooves are too shallow, the Groove-Rite Tool is again employed, and the groove is deepened to the proper depth for the expander rings.

Use a good pair of ring pliers or spreaders to install rings on pistons. This leaves one hand free to guide the heel of the ring over the head of the piston. Open gap just barely enough to get ring over head of piston and into proper groove. Be sure that ring features are installed according to drawing and notes on envelope.

Several simple principles govern the placing of ring gaps for best operation. Rings may turn slightly, so start them out with the gap of rings in adjacent grooves as far apart as possible, which is 180°. Also place the expander gap opposite the gap of the cast iron ring it backs up.

Keep the iron ring gaps away from the thrust sides of the piston, which means they should be lined up with the pin hole.

The two steel rails of Duplex oil rings should be separated by the cast iron spacer and have their gaps 180° apart, but in line with the thrust sides of the piston. In other words, the four gaps of the four component parts of this ring are spaced 90° apart, giving the best initial set-up.

The piston and ring assembly should be installed carefully in the cylinder. The ring belt should be dipped in clean light oil. A two-band ratchet type compressor should be used to install the pistons, forcing them into the cylinder with a steady push on the end of a hammer handle. This is the best type compressor to use. However, the careless use of any compressor may result in ring and land breakage if the bottom ring slips out and strikes the top of the cylinder. A steady push on a hammer handle, rather than tapping the assembly in, is recommended for this reason. If a ring should protrude, the steady pushing movement will merely stop, whereas, the force of tapping might break the cast iron spacer of the Duplex Oil Control ring and the piston land.

Once rings are installed correctly, the cleanliness of the job, accurate tune-up, and proper run-in will determine the mileage of efficient performance.

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McQUAY-NORRIS SHOP SERVICE

ROTARY WATER PUMP SEAL CLASSIFICATION AND APPLICATIONS

Bulletin No. 29

Due to advanced designing of engines and cooling systems, water pumps and seals have also had to be redesigned to be able to withstand increased cooling system pressures, up to 14 pounds per square inch, and increased circulation of the coolant. Years ago the gland type packings were able to give satisfactory performance, but these type pumps would hardly stand up under present conditions. Also, periodic adjustments and replacement of packing material has been eliminated. Fan belt loads have been amazingly decreased due to the ease of turning the present ball bearing pumps as compared with the excessive drag of the packing material in old style pumps.

At the present time there are six types of rotary seals used in water pumps. The main object in mind when manufacturing any type water pump seal is to form a water-tight seal of a turning shaft with a minimum of load or drag on the operating belt. This is accomplished in rotary type seals by use of one revolving seal face maintained in close contact with a low friction material washer by a spring and rubber arrangement fitting on the shaft and backed up by a stationary seal face.

A number of rotary seals have been designed and used, but the most efficient seems to be the "bellows" type, which is used in the greater percentage of McQuay-Norris complete water pumps and pump repair kits. This type seal is used in the first two seal assemblies as follows.

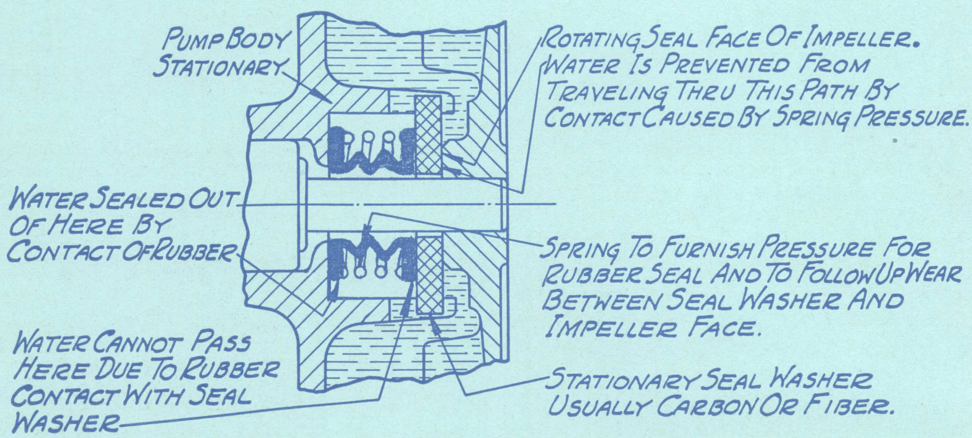

Fig. 1

In the first type (Fig. 1) as used by Oldsmobile and Pontiac, the seal assembly is located in the pump housing. A bellows type seal fits tightly against a machined surface in the housing and against the back side of either a carbon or fiber seal washer which is mated to the lapped seal face of the impeller. A spring around the bellows exerts pressure against the sealing surfaces and takes up normal wear of the seal parts.

Pump repair kits of this type are furnished by McQuay-Norris with the following numbers:

PA-217	Oldsmobile	PA-187R	Pontiac
PA-298	Oldsmobile	PA-215	
PA-267	Oldsmobile		

The second type is basically the same as the first except that the assembly is completely reversed. The seal face in the pump housing is machined and lapped and the seal assembly is carried in the impeller. Repair kits of this type are furnished by McQuay-Norris in the following numbers:

PA-211	Buick	PA-220	Chevrolet	PA-117	Chrysler, Dodge, DeSoto, Plymouth
PA-212	Buick	PA-275	Chevrolet	PA-285	Chrysler
PA-213	Buick	PA-290	Chev. Truck	PA-190	Chrysler
PA-274	Buick	PA-296	GMC Truck	PA-207	Dodge Truck
PA-300	Buick	PA-204	GMC Truck	PA-202	Dodge Truck
PA-153	Ford and Mercury	PA-293	GMC Truck	PA-285	Dodge Truck

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The third type seal (Fig. 2) was used quite extensively by the previous cars before the bellows type came into use. It is somewhat the same as the second type except that it does not form a water tight seal on the impeller but around the shaft. This seal of course turns with the shaft and impeller so that the spring is located between the impeller and rear of the seal washer. Kits of this type are furnished by McQuay-Norris in the following numbers:

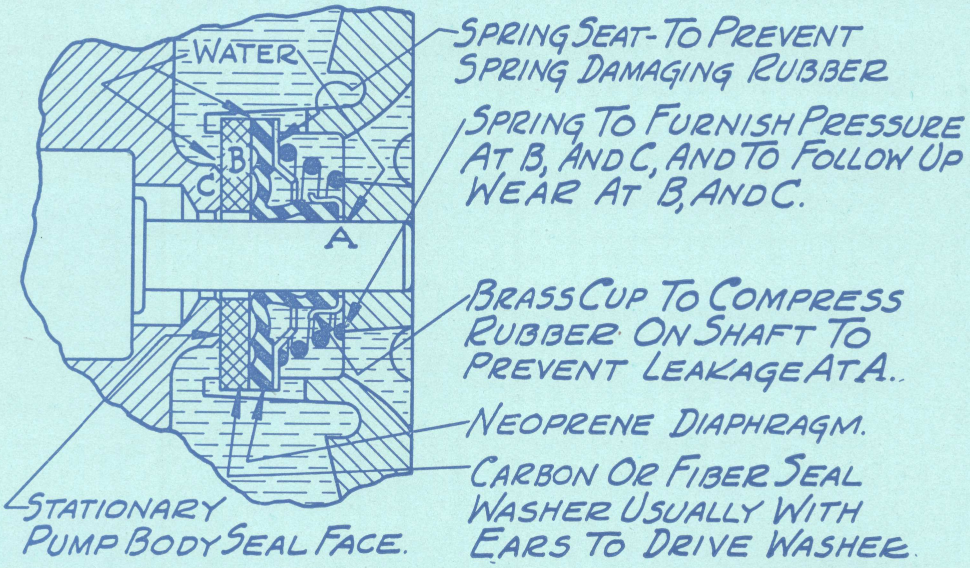


Fig. 2

PA-237 Allis-Chalmers
PA-244 Ford 6- & 4-cyl.
PA-281 Studebaker President
PA-243 Studebaker Champion
PA-208 Studebaker Champion
PA-297 Studebaker Champion

The fourth type (Fig. 3) is almost identical to the third except that the seal is formed on the shaft by spring pressure behind a brass cup spreading a V groove in the composition seal washer so it pinches tight around the shaft. The spring rides between the impeller and the seal which in turn gives the necessary pressure on the seal washers. This type seal is furnished by McQuay-Norris in the PA-151R and PA-242 kits for Lincoln Zephyr.

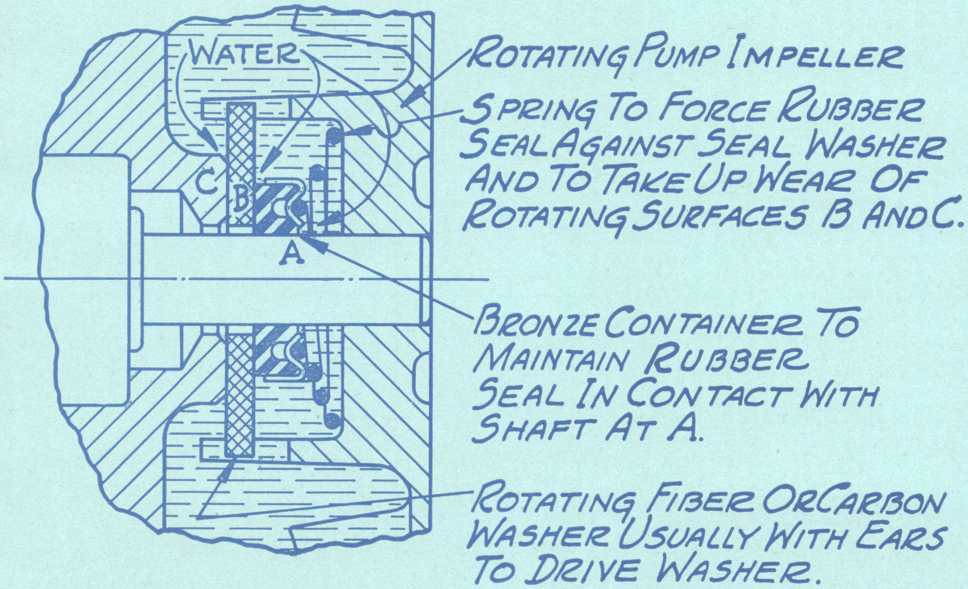


Fig. 3

The fifth type is furnished by McQuay-Norris for International, PA-172, and Allis-Chalmers, PA-237. It is the same style as used in type No. 4, except that the seal face is concave and the seal washer is made of steel and is of convex design. The shaft seal is the same design as type No. 4.

Cadillac and LaSalle use a type entirely different from any of the preceding. It consists of several packing rings and a spring placed between the two shaft bushings to form a water tight seal.

Kits containing this type seal are furnished by McQuay-Norris in Numbers PA-239 and PA-241.

The seal used by the 60 h.p. model Ford is unique. It consists of a bakelite impeller which rides against the housing and is held in place by a spring running through the hollow pump shaft. McQuay-Norris furnishes this type kit in numbers PA-154 and PA-201.

Repairmen should become acquainted with the most recent water pump development which is the "cartridge" seal appearing first on the 1949 Buick Dynaflow. The cooling system of this engine operates under 13 pounds per square inch pressure so the seal must be efficient and replaced periodically. The seal is actually the "bellows" type shown in Fig. 1, except that it is contained in a thin brass case and is installed as an assembly. The housing is recessed to hold a brass cup into which the cartridge seal fits. The lapped seal surface of the impeller turns against a carbon washer that is part of the cartridge. This design makes replacement of worn out parts comparatively easy. The McQuay-Norris PC-42S water pump is equipped with this "cartridge" seal.

McQUAY-NORRIS SHOP SERVICE

ADJUSTING HYDRAULIC VALVE LIFTERS IN 1949 BUICK ENGINES

Service Bulletin No. 30

For the purpose of decreasing engine noise, all 1949 model Buick engines are equipped with hydraulic valve lifters. Zero valve lash, meaning no tappet clearance, is correct, because the hydraulic lifters automatically compensate for thermal expansion and contraction of the valve mechanism.

Some repairmen have been unable to get information on the proper method of setting these lifters, and do not understand the extreme importance of clean oil in these engines. Even the slightest amount of dirt or sludge will cause erratic operation and so all work must be done with the utmost care and cleanliness.

After a valve refacing and reseating job and a thorough cleaning of the hydraulic valve lifter parts, the following adjustment must be made. Be certain that the valves, rocker arms, push rods and hydraulic lifter parts are back in their proper places and then, with the engine cold, turn the crankshaft until number one cylinder is in the firing position ("TDC" mark on flywheel will be lined up with mark on flywheel housing, and distributor rotor will be in firing position for number one cylinder spark plug wire).

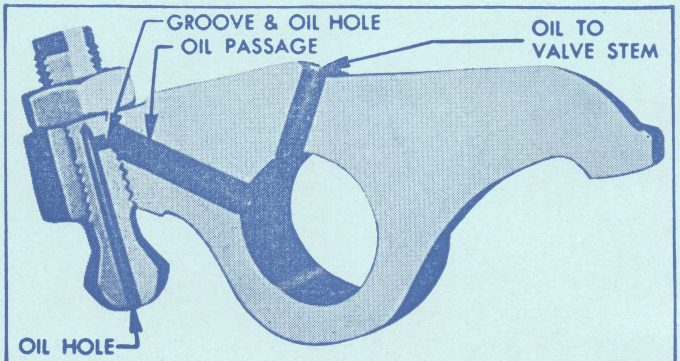
Then loosen all of the lock nuts on the rocker arms and run the following ball studs down to a snug feel between the push rods and the closed valves so there is no lash:

1 - 2 - 4 - 7 - 8 - 11 - 12 - 14

(Numbering of ball studs runs from front of engine to rear regardless of which are on intake and exhaust valves)

The correct setting for proper functioning of the hydraulic lifters is now accomplished by turning each of the above ball stud numbers down an additional two turns.

Before tightening the lock nuts, one extremely important check must now be made to be sure oil has a free passage from the rocker arm shaft to the ball stud, through the center of the ball stud and down the push rod to the hydraulic lifter parts. The oil holes in all of these parts were carefully cleaned of all dirt and sludge before assembly, so all that remains is to make certain the oil hole in the rocker arm leads into the hole and/or groove in the ball stud. This means that the oil groove in the ball stud must be hidden from view due to being below the top surface of the rocker arm. If the oil groove around a ball stud still shows after one more additional turn of the ball stud, the push rod and lifter must be replaced. The correct position of the ball stud in the rocker arm is shown in Fig. 1. Run down and tighten the lock nuts after making this check.



ROCKER ARM USED WITH HYDRAULIC VALVE LIFTERS

Fig. 1

Next, turn the crankshaft until number 8 cylinder is in the firing position. Run the remaining ball studs down to a snug feel against the push rods. These stud numbers will be:

3 - 5 - 6 - 9 - 10 - 13 - 15 - 16

Complete the setting of the remaining hydraulic lifters by turning the above ball stud numbers down two additional turns. Tighten their locking nuts only after checking to see that the oil groove in the ball stud is hidden below the surface of the rocker arm as in Fig. 1.

These engines are equipped with oil filters and only filtered oil reaches the valve mechanisms. The filter should be renewed every 5000 miles.

CORRECTING NOISY VALVES IN 1946 AND 1947 BUICKS

The 1946 and 1947 Buicks did not come equipped with oil filters. When the motor oil is not kept clean in these models by changing frequently or by installing an oil filter which is renewed every 5000 miles, sludge and foreign particles are very apt to clog the wire screen in the rocker arm line. This condition reduces or stops the flow of oil to the overhead valve mechanism. Running too dry causes these parts to become quite noisy.

The screen is located behind the brass fitting which connects the oil line tubing to the top of the motor block. It is a simple operation to remove this screen and wash out the dirt and sludge. At the same time the oil lines should be cleaned and also behind the push rod cover and under the rocker arm cover. When reassembled and running, the clean screen will allow free passage of oil to the rocker arms, ball studs, push rods and tappets, so that the engine will be noticeably quieter.

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CORRECTING MAIN BEARING CAP DISTORTION

Service Bulletin No. 31

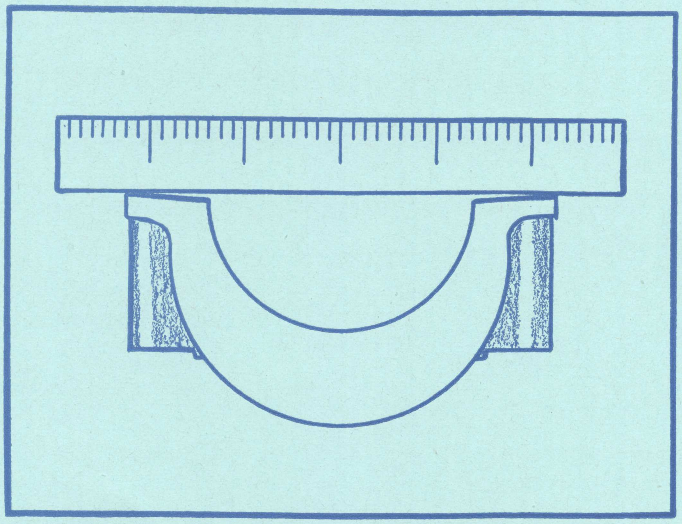


Fig. 1

When new main bearing inserts are being installed, the bearing caps should all be checked for flatness of the machined mating surfaces. With the insert removed, hold a straight edge across the two machined surfaces that fit against the motor block. If only the outside corners contact the straight edge (Fig. 1), then dressing down the cap is necessary so that the new bearing will be held tight enough in the block and cap to fit the journal properly and have good heat transfer.

The best method to accomplish the dressing down operation is to lay a 9″ x 11″ piece of No. 2/0 abrasive cloth, grit side up, on a flat, hard surface, such as a steel or maple bench top or a pane of glass. Holding the bearing cap in the palm of one hand and keeping the abrasive cloth from slipping with the other, rub the machined mating surfaces back and forth on the abrasives, as shown in Fig. 2.

This will grind down the high corners and clean up toward the center. Continue this operation only until the grinding marks extend to the inside corner on both sides because the inside diameter should not be reduced.

With caps dressed down and still the original inside diameter retained, the mating surfaces will have 100% contact again and the new precision insert bearings will be held tight. Not only will the bearings stay in longer, but less oil will bleed out of the mains, with the desired result of higher oil pressure to the new rod bearings so they will receive normal lubrication. Furthermore, there will now be normal rod bearing throw-off to furnish adequate lubrication to the cylinder walls so the entire job will perform better.

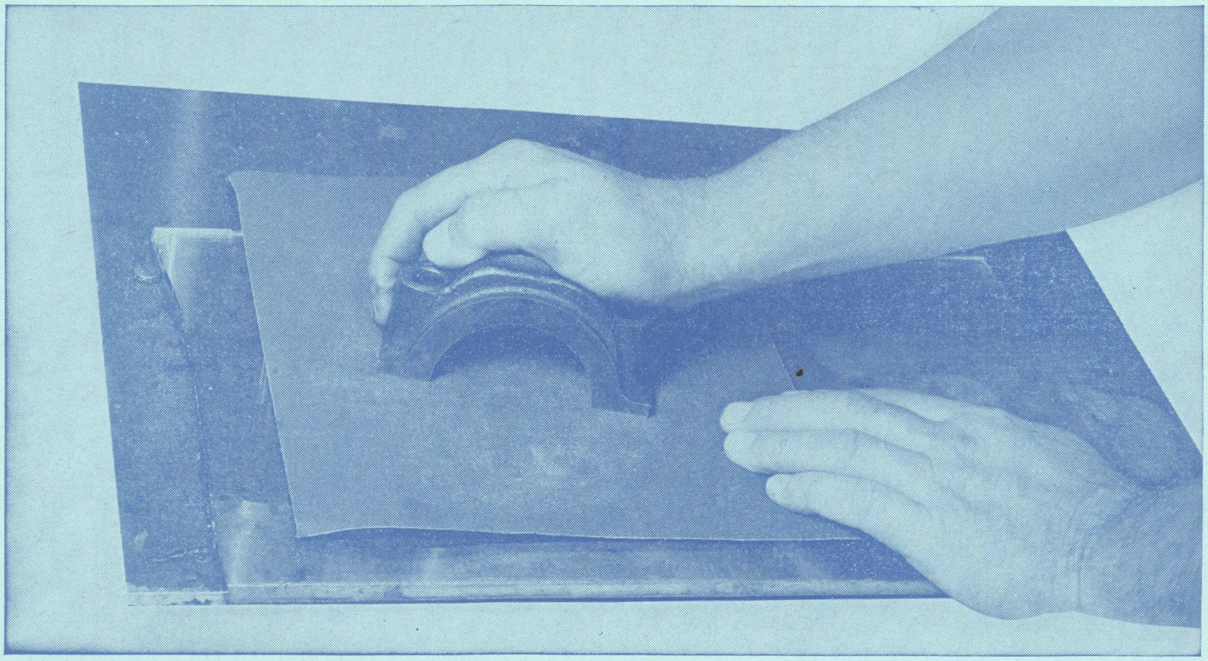


Fig. 2

NON-MAGNETIC VALVES FOR HARD SERVICE

Bulletin No. 32

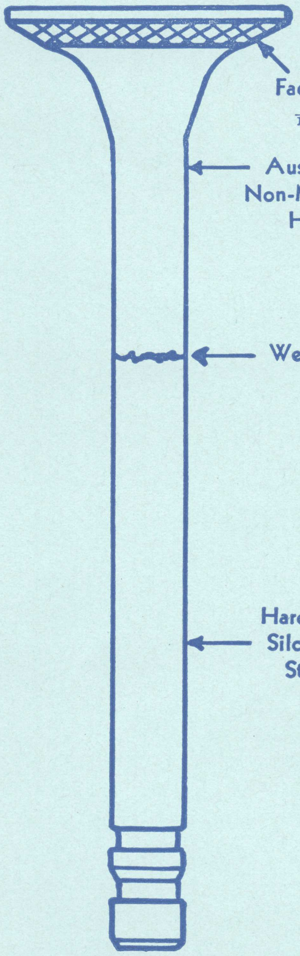
We all know that engines are operating under heavy load and top speed these days, so that valves in particular are giving trouble due to overheating.

If it were not for a steady development of valve steels as improved anti-knock fuels have become available, there would not be the special and super valves to cope with the situation. The high power fuels permitted designing engines to produce more horse power, but this evolution resulted in a higher operating temperature of the parts exposed to the combustion gases, so special parts are needed.

Speaking of valves, the head, of course, gets the most heat, so should be made of special heat and corrosion resistant steel. For this use, high chrome-nickel steel, called "Austenitic", has proven most satisfactory. The 15 to 20% chrome plus the 8 to 14% nickel alloy content so dilutes the steel that it is no longer attracted to a magnet. Therefore a small permanent magnet, which can be found in most every garage, is all that is needed to distinguish a special valve from a regular valve.

The one tricky characteristic of Austenitic steel is its 35% greater coefficient of expansion, which necessitates allowing more lash or tappet clearance when replacing regular valves with special non-magnetic head valves. In order to cover heavy duty service and other variations, the general recommendation is 50% more clearance. This can be varied with experience, as it must be kept in mind that too little back lash holds valves open so they overheat, while too much lash not only makes unnecessary noise, but runs the chance of valve breakage due to contacting the seat at too high a velocity. Excessive lash adversely affects performance by causing late valve opening. In general, overhead valve engines require slightly more lash than L-head engines.

The reason the magnet test is so important is that many engine manufacturers in recent years have used Austenitic non-magnetic valves for original equipment. In such cases the lash or tappet clearance specified by the factory is correct for the special valves.



Super Valve with Eatonite Face
Figure 1.

Only the head of most special valves is made of Austenitic steel, because it cannot be hardened enough by heat treatment to resist guide scoring and tip wear. Therefore the stem is usually made of a hardenable Silcrome steel and welded to the Austenitic head. This does not make a weak valve because the weld is located below the critical stress point where the throat tapers into the stem. See Figure 1. Actually, we have never seen a two-piece valve broken through the weld.

In heavy duty truck service, combustion chamber temperatures may be reached which will burn Austenitic steel, especially near the thin face of the valve. To overcome this condition, Stellite, composed of cobalt, chrome, tungsten and molybdenum, was first used on the face of special valves in order to take advantage of its inertness and hardness at high temperatures. Stellite, however, was primarily developed for the tool industry, so a similar alloy has now been specifically developed to meet the requirements of a valve face under extreme operating conditions. This new material is known as "Eatonite" and is composed of nickel, chrome, tungsten and cobalt. Like Stellite, it is expensive and difficult to forge, so is applied to a valve head by a unique welding operation.

Two-piece valves having a 1/16" thick face of "Eatonite" are known as "Super Valves" and although expensive will give long service under severe operating conditions. Super Valves are available through McQuay-Norris Distributors.

Another valve that has been developed for hard service is the salt-cooled type, having a hollow stem partially filled with a sodium salt. In operation the salt is molten and so helps keep the valve head cool by mechanically moving heat down to the stem. However, this action makes the stem hotter, and if lubrication cannot be maintained, there will be rapid guide wear, thus creating another problem.

At the present time the Super Valve with the "Eatonite" face and "Austenitic" head furnished by McQuay-Norris is the solution for most valve failures. For the very tough jobs an installation of Super Valves with the new rotators on the end of the stem will give the longest possible mileage.

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PIN FITTING UP TO DATE

Bulletin No. 33

In the old days before diamond boring of piston bosses, precision lapping of pins and modern shop pin fitting equipment, the high spots on pins, bosses and bushings had to fit rather tight when put together so that after these high tight spots wore off in a few hundred miles the pins would not be loose enough to knock.

For repairmen to still insist on pins being fit tight enough for the pin to almost hold up the weight of the rod when the piston is held with the rod extended horizontally, is definitely working a hardship on the piston manufacturer in the case of an oscillating type pin and on the parts distributor's shop in the case of a set screw or full-floating type pin.

Piston bosses and bushings and sometimes the rod bushings are now diamond bored perfectly round, straight, smooth and to the correct size. Pins are precision ground and lapped to a .0002 accuracy and 4 to 6 micro-inch finish. With this extreme accuracy a slight clearance for an oil film should be allowed between all pins and bronze rod bushings. A pin properly fit will almost drop through of its own weight when tried dry, but will have a drag when oiled. The bronze bushings in cast iron pistons with oscillating pins, like the Chevrolet, should never be fit tighter than a light thumb pressure dry. The actual bearing area will be practically 100% so that the longest possible life is assured, providing the job is clean and the oil is kept free from any form of abrasive material.

The feel fit of the pin in bosses of a set screw type iron piston has not changed. In the boss containing the set screw the fit must be a light drive. Most set screw type pins are slotted on the other end so the fit will be looser and so permit breathing of the piston.

The clamping device in the rod of oscillating pin designs makes certain the fit of a standard or oversize pin will be tight enough in the rod. Most oscillating type pins are strengthened in the center, but care should be taken not to overtighten the clamp, or the pins will be distorted enough to cause galling.

The full floating pin design in aluminum pistons is in greatest use and is the most critical in regard to pin fit. In the piston bosses, the pin must have a heavy palm fit dry to insure that there will be no more than oil clearance when the engine reaches normal operating temperature. The pin will turn freely in a properly fit rod bushing when the engine is cold, so there will be no slap noise, galling or scoring, not to mention lock ring trouble from tight pins.

An oscillating pin in an aluminum piston must be fit with a light palm fit dry, since all of the pin turning occurs in the piston boss.

Piston and pin manufacturers selective fit to .0001, so in the field, to obtain the benefits of this extreme accuracy, be certain each pin is assembled to the piston in which it was received. Be sure all parts are perfectly clean. Then use only a light oil on the pin and tap into place with a soft hammer. Not only does careful and accurate pin fitting give long quiet operation, but also insurance against the end of a pin scoring a cylinder wall.

Pins in set screw type pistons must be assembled so the hole in the pin lines up exactly with the set screw. The set screw must go in without binding and fully compress its lock washer, otherwise it will come loose in operation. Likewise, oscillating pin clamps or bolts must be carefully tightened and locked with the pin in the correct location.

With respect to getting out against the cylinder wall, full floating pins are again most critical. As already indicated, this type pin at operating temperature floats in the piston bosses between two piano wire lock rings set in grooves near the outside ends of the bosses. If the pin has a free cold fit in the rod bushing, as already recommended, and the piston assembly is in good alignment, there will actually be the condition of the pin floating between the lock rings with no appreciable pressure or contact between the two. But let the pin have a tight cold fit in the rod bushing and realizing that the engine must run a good while before the heat from the combustion fully warms up the rod forging, then let there be a bent rod or end play of the rod or crankshaft, as often exists after long mileage, or just an offset rod such as the Plymouth and what have you. Nothing more nor less than a hammer having the pin for a head and the rod for a handle. Now the tight pin has real meaning, for this hammer pounds against one lock ring till it either batters out the groove in the piston boss or wears out and fatigues the lock ring steel till it breaks. Then of course the lock ring and pin get out against the cylinder wall, causing serious damage.

For everyone's benefit request a freer pin fit.

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INSTALLING CHEVROLET LOWER CONTROL ARM PIVOT PIN AND BUSHING

Bulletin No. 34

There are two points to understand and pay particular attention to when installing a new lower control arm pivot pin in a late model Chevrolet front end suspension.

Although not visible to the eye, the threads on the pivot pin have three different pitch diameters, with the largest next to the hex head. For a distance of 5/8″ from the head, the pitch diameter is .716. The center and major portion of the threads have a pitch diameter of .702. The last 1/4″ of threads have the pitch diameter reduced to .692 for easy starting. The center portion of the threads with the .702 pitch diameter, matches the threads in the knuckle support bushing with .006 - .008 clearance for grease.

The important point is the .716 pitch diameter for the last 5/8″ of threads, which are purposely made to bind in the front support arm in order to lock the pivot pin in place. No nut, lock washer or cotter pin is used so the tightness of the last 5/8″ of threads is relied on to keep the pin from coming loose in service. Therefore repairmen should expect the pivot pin to turn extremely tight as it approaches the correct operating position.

The second important point to watch is starting the pivot pin threads properly in the rear arm after it has been turned through the front arm and the knuckle support. The lower control arms fastened to the coil spring seat form a yoke commonly known as the "A" frame or wishbone. The two arms between which the steering knuckle support is centered are approximately 2 3/8″ apart, so that care must be exercised to get the pivot pin threads started straight in the rear arm. If the threads do not index exactly together, turning the pivot pin farther will start to spread the yoke. This should not be done, as it will cause trouble. Instead, the repairman should use a "C" clamp, as shown in Fig. 1, to compress the front and rear arms together slightly as the pivot pin is turned into the rear arm. A slight adjustment of the "C" clamp will make it easy to find the correct position where the threads will index correctly. In this way crossed threads will be avoided. The pivot pin can then be turned all the way in to make a good job, even though considerable pressure on a husky 1″ socket wrench will be required because of the oversize pitch diameter on the last 5/8″ of threads.

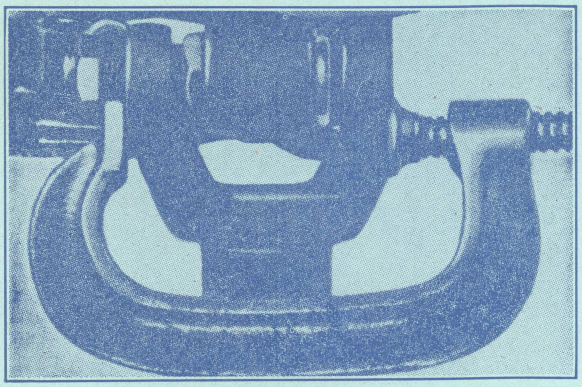


Fig. 1

The threaded bushing in the knuckle support is always replaced with the pivot pin. This operation is easily performed so long as the wheel is turned to the extreme outward position after the old worn pin is unscrewed. This locks the knuckle support so it cannot move outward at the bottom while the bushing is being screwed out or in, with a 1 1/8″ socket wrench.

Besides the pivot pin and bushing, a McQuay-Norris repair kit contains two new rubber seals. To avoid damaging these seals during installation, one should be placed around the front arm and the other over the exposed end of the bushing after it has been screwed tight in the knuckle support, but before the new pivot pin has been started (see Fig. 2). Then after the pin is in place and the knuckle support centered in the "A" frame, a stiff wire hook should be used to pull the front rubber seal around the control arm and into place. The rear rubber seal is easily rolled off the bushing and into its proper place so that the two rubbers seal the pin from road grit.

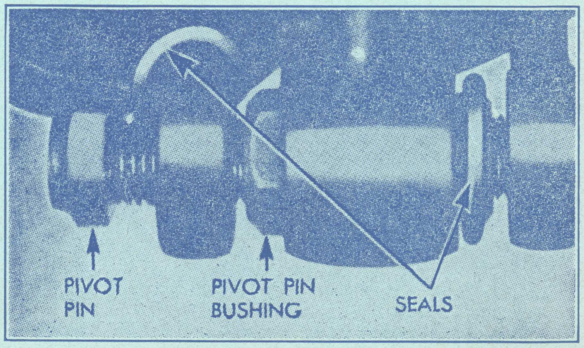


Fig. 2

KAISER FRAZER CRANKSHAFT THRUST BEARING

Bulletin No. 35

Not only is the Kaiser Frazer engine designed to take the thrust of the crankshaft on the front main bearing, but bronze thrust washers are used. The engines produced in 1946 and most of 1947 have one bronze thrust washer located in the timing gear case which is positioned by three dowel pins set in the outside of the crankcase casting. The front main bearings in these early engines are made with one flange which naturally goes to the inside.

In the 1948 and 49 engines, the flange has been eliminated and in its place a second bronze thrust washer is used. The present bearing is plain and fits between the two washers which take the thrust. The thrust washer design is the same except that the dowel pin holes have been eliminated.

It should not be necessary to replace these thrust washers during the normal life of the engine, but if the engine is pulled out of the chassis and the crankshaft renewed for any other reason, it is best to renew both washers.

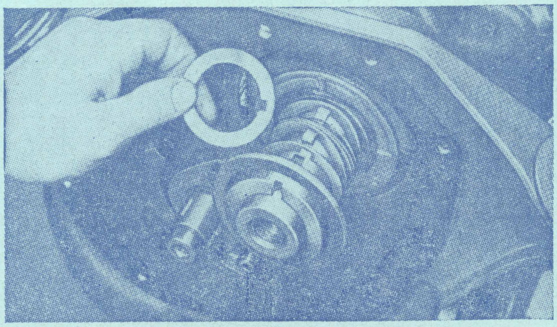


Fig. 1

When rebuilding an early engine, the plain bearing can be used, provided a thrust washer is installed on each side of the insert. No dowel pins are necessary.

This latest design not only makes replacement of the front main easier, but makes possible an adjustment of the crankshaft end play, to take up wear. The front thrust washer is backed up by shims and a thrust plate (see Fig. 1). The correct end play is from .004 to .006.

When the engine is in the chassis, the crankshaft end play is checked and adjusted as follows. Remove the clutch cover pan and pry flywheel to see if end play is excessive. If so, make sure cause is not loose vibration damper bolt, which requires a torque of 100 to 130 foot pounds. If still excessive, remove radiator, timing gear case, and gears.

To help in checking end play accurately and quickly as shims are added to take up the wear, cut a $2\frac{7}{8}''$ length of 2″ diameter steel tubing or pipe with square ends. Use this sleeve in place of the timing gears by slipping it over the end of the crankshaft, and then tightening it against the thrust plate by means of the vibration damper washer, bolt, and a torque wrench. When tightened to the tension specified above, set up an indicator gauge against the end of the vibration damper bolt, as shown in Fig. 2. Adjust indicator to read zero. Force crankshaft forward from beneath engine by prying against flywheel. Indicator will register the amount of end play. Add enough shims to obtain .004 to .006 end play, and recheck.

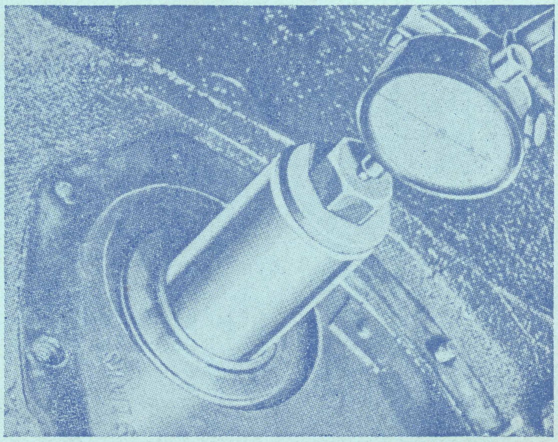


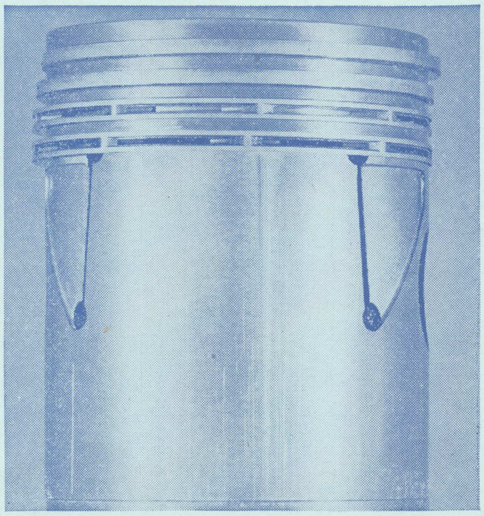
Fig. 2

McQUAY-NORRIS SHOP SERVICE

TIME TESTED McQUAY-NORRIS AUTO PARTS PROVEN IN SERVICE

GRIND U-SLOT PISTONS WITH CAM "E"

Bulletin No. 36



U-Slot Piston

The field experiences an occasional case of scoring in Chrysler products equipped with U-slot pistons, even after the cooling system has been thoroughly cleaned and a new water distributing tube installed.

It has been determined that the quality of the iron in some motor blocks cast over the last few years is questionable, and in a rare case or two the casting is faulty, in that the water jackets are filled in with iron or not correctly shaped, so that the block has to be replaced to overcome repeated scoring. Such cases, however, are quite rare.

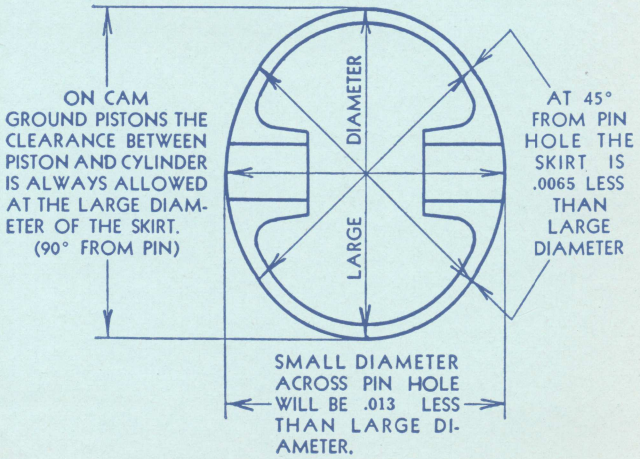
Furthermore, cars are being run faster and harder with roads being steadily improved. All of which means that the hard worked pistons need a greater factor of safety against scoring.

The car owner will not stand for allowing slightly more skirt clearance, because the engine will then be noisy due to piston slap, at least when started cold. Therefore, more clearance on the thrust sides of the piston is not a practical solution.

The only place where more clearance can be allowed without causing noisy operation is on the pin sides, so the old standby of grinding the skirt with more relief is the best solution. The use of standard cam contour "E", having .013 relief, instead of "C", having .009, or "D", having .012, has proven very effective for engine rebuilders. They have been using "E" for a long enough time and their engines are used in every conceivable service, so that this practice can be considered a good general recommendation.

Therefore, piston grinders in the field should mark their records and their stock of U-slot pistons so that cam "E" (see drawing) will be used from now on. They will be noticing McQuay-Norris U-slot pistons coming through ground to cam "E" contour. Old stocks of finished pistons can be used as they are, but it is advisable to grind a set on cam "E" to fix the occasional troublesome engine.

STANDARD CAM **E**



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EARLY 1949 FORD TOE-OUT, LATE PRODUCTION TOE-IN

Bulletin No. 37

The difference between 1/8″ toe-out and 1/8″ toe-in can cause or correct tire squealing and wear on turns, so repairmen must recognize early and late 1949 Ford car production.

The early 1949 models are identified by having a threaded idler arm bracket on the inside of the frame so that the lower mounting bolt screws tight in the bracket without using a nut. These models must have the wheels adjusted to toe-out 1/8″ to 3/16″.

The new style idler arm bracket on the late 1949 models has a plain drilled hole through which the lower mounting bolt passes and is tightened to the frame by means of a nut screwed on the threaded bolt. These models need the conventional 1/16″ to 1/8″ toe-in to make turns without squealing and tire wear.

The idler arm and bracket are located on the right side of the frame directly opposite the Pittman arm on the steering gear box and can be viewed by raising the hood. Late 1949 models have a nut on the lower mounting bolt, so wheels must toe-in.

If it is ever desired to change over a toe-out model to a toe-in model, the Pittman arm, the bracket and the complete idler arm assembly must be replaced with the late 1949 style parts.

AUTOTHERMIC PISTON IN LATE 1949 FORDS

In order to combine freedom from piston slap in cold engines with absence of scuffing at high speed and under heavy load, Ford has changed over 100% to the controlled expansion steel strut Autothermic piston design, starting with engine No. 8BA-641087 and 8R series 195401.

The new piston can be used in the older engines except that it should never be used in a steel sleeve. It is not recommended to substitute the old style piston in the late engines.

The Autothermic piston has a small identification mark on the top of the head directly over one pin boss. This dent must be installed toward the front of the engine so the 1/16″ offset of the pin will be on the thrust side of each cylinder.

The proper skirt clearance is 6 to 12 pounds pull on a 1/2″ wide feeler strip, .0015 thick.

The connecting rod has also been changed to have a 5/64″ spurt hole drilled at an angle in the side of the bearing flange web. The purpose is to increase cylinder, piston and ring life by increasing lubrication on the cylinder walls at all speeds. These spurt holes must be faced toward the valve mechanism in installation.

These new connecting rods can only be used in engines equipped with neoprene seals on the outside of the intake valve guides, and with the increased capacity oil pump.

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McQUAY-NORRIS SHOP SERVICE

AVOID PISTON RING BREAKAGE

Bulletin No. 38

Except in the very rare case of a piston ring having an internal gas pocket or other foundry flaw, breakage in installation can be avoided by using the proper tools and exercising a little care.

Cast iron through the years has been the predominant piston ring material because its 3% by weight of graphitic carbon content, which is 10% by volume, gives it excellent wear life, combined with the necessary resilience (springiness). Heat stability enables it to retain loading under repeated heating. With these essential properties of wear life, resilience, and heat stability, cast iron also has the natural property of brittleness when highly stressed, which goes with resilience. This minor brittleness property of cast iron must be accepted, since no perfect material has or will be found. Steel is not brittle, but falls down on the essential property of heat stability, so it is not suitable in top compression rings.

Piston ring engineers are fully conscious of cast iron's physical properties when designing each type of piston ring, including the spacers for oil rings having steel rails, and although modern engines demand the ultimate in ring loading to get good oil and blowby control, McQuay-Norris engineers and metallurgists have very successfully handled the problem. The metallurgists have alloyed .75% phosphorus (producing 7.5% by volume of an iron-phosphorus compound) to produce our Phosalloy electric furnace iron, which gives a remarkable improvement in heat stability, scuff resistance, and resilience. The design engineers have balanced ring thickness, free gap and cross section specifications for each nominal cylinder size and the regular oversizes, so that each type of ring will safely open to a large enough diameter to slip over the piston head without breakage.

Remember that the inside diameter of a piston ring needs open up to the piston land diameter only once in its useful life, and that, of course, is during installation. Also remember that cast iron being somewhat brittle, is much stronger in compression than in tension and the tensile stress is a maximum when the ring is opened. Therefore, in installation, favor the ring by spreading its ends as carefully as possible, so it will not be broken or deformed. A deformed ring is almost as useless as a broken one, because it will not conform to the cylinder wall or fit free in the ring grooves.

Fig. 1

The best precaution against breakage is to use a good ring pliers or spreader which leaves one hand free to guide the heel of the ring over the head of the piston (Fig. 1). Open the gap slowly and just barely enough to get ring ends and heel down over the lands and into the proper groove.

If no tool is available, still follow the above recommendations as closely as possible. Spread the ring slowly with the thumbs while keeping it level between the index fingers. Use the other fingers on both hands to center and guide the ring onto the piston. Do not overspread, bend or twist the ring.

Once the rings are properly fit and installed on the pistons according to Shop Service Bulletin No. 28, the only chance for breakage would be severe operating conditions. The better material and design in McQuay-Norris rings must be the reason that we practically never hear of breakage in operation being experienced by customers in the replacement parts business.

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KEEP DIRT OUT OF OVERHAULED ENGINES

Bulletin No. 39

Dirt will wear out engines. And worn engines do burn oil—and lack the power they should have. Sometimes engines wear out extremely fast. We've seen cases where an overhauled engine lasted only 500 miles—because of dirt.

If dirt can be the cause of such serious trouble, we should know more about it. How does it cause engine wear? How does the wear affect the engine? And how does the dirt get into the engine?

Dirt or dust causes engine wear because it is abrasive. When dirt passes between two bearing surfaces, it wears those surfaces. Dirt causes ring and cylinder wear when it is between the ring faces and the cylinder wall.

Dirt causes cylinder and piston wear when it is between the piston and the cylinder. Dirt causes bearing wear when it is between the crankshaft journals and the bearing inserts. And dirt also causes wear of the top ring grooves in pistons.

Looking at, or even feeling the dirt that causes wear, you might not think it possible to cause wear. Yet dirt acts just like the abrasive material in the grinding compound used for seating valves. Worn rings cannot exert enough pressure against the cylinder wall because of their reduced thickness. They can't prevent blowby. Worn rings are also more apt to flutter and break.

If the cylinder walls become excessively worn, the piston rings have additional work to do, even if the rings themselves are new and not worn.

At the present time, the wear of the top ring groove is one of the major evils of dirt.

Worn connecting rod bearings throw an excessive amount of oil onto the cylinder walls. Again the rings are forced to control more than the normal amount of oil.

Dirt in the air of the fuel mixture will cause the intake valves and guides to wear from the top down. Both intake and exhaust valve stems and guides will be worn from the bottom up by dirt in the lubricating oil. Worn valves result in lost compression and power. Worn guides allow oil to get into the combustion chamber so that more is consumed.

Another place that dirt causes wear is in the carburetor. This condition is not generally found, but in some sections of the country it is an important factor and must be considered. Dirt in the gasoline can wear the float valve. If the float valve becomes worn, it will not seat properly. If the float valve does not seat properly, gasoline may be pumped under full pressure right through the carburetor into the engine when the engine is running at idle speeds.

When this condition exists, the engine does not burn all the fuel. Raw gasoline on the cylinder walls washes away the oil film. If there is no oil film on the cylinder walls, the ring faces and cylinder walls will scuff and wear from metal-to-metal contact.

Any one of the results of dirt produced wear is bad enough in itself. But in dirty engines all of these conditions usually exist at the same time.

The dirt we've been discussing can get into the engine in just four ways:

1. Dirt in the air supply to the carburetor.
2. Dirt in the fuel supply to the carburetor.
3. Dirt in the crankcase breather system.
4. Dirt left in the engine after an overhaul.

Often an examination of repair jobs which failed to give normal mileage will show how the dirt got into the engine. A dirty, unserviced air cleaner is good evidence when backed up with finding the top piston ring most severely worn and the lower rings on the piston worn less proportional to their distance from the combustion chamber. Of course, if the manifold was not removed during the valve grinding operation, grit and metal cuttings lodged in the intake passages will be sucked into the combustion chambers with the first few charges of air and fuel. This condition is responsible for many short lived ring jobs and shows up in compression ring wear. Dirty fuel not only shows up in compression ring wear, but in difficulty keeping the engine running smoothly due to clogged fuel pump strainer and enlarged carburetion jets.

Failure to clean dirt out of crankcase, pan, valve alley, oil filter, oil lines and crankcase breather system will result in abrasives being picked up by the new oil and circulated throughout the engine. The piston rings will wear up from the bottom so that the oil rings will show the greatest reduction in thickness. In some such cases the top compression rings will show very little damage. Wear from dirt in the oil shows up very quickly in the bearing linings. The babbitt has the property of embedding a small amount of foreign particles to protect the crankshaft journals. However, if the oil carries too much dirt and the particles are large, they will be filtered out by the small original bearing clearance, causing build-up and grooving in the linings.

Dirt left or allowed to get into an engine will wear out new parts so rapidly that every mechanic should keep the necessity for cleanliness uppermost in his mind.

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